Novating Knowledge in Business Networks: Facilitating Cognitive Consistency in the Construction Industry

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Abstract

Loose couplings within a network are thought to inhibit learning and innovation as evidenced in the construction industry characterised by its loose couplings in the permanent network and tight (but albeit short-lived) couplings at the level of individual projects. In this study, we explore the practice of novation, a method employed within the construction industry of ensuring cognitive consistency and learning within the temporary project network by retaining the services of key actors (such as architects and engineers) at different phases of a construction project. Through interviews conducted with a variety of actors in the construction industry, we define novation, its purpose, and the way in which it may influence learning in networks.

Key words: Novation; Learning; Knowledge; Business Networks; Construction industry.

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Abstract

Loose couplings within a network are thought to inhibit learning and innovation as evidenced in the construction industry characterised by its loose couplings in the permanent network and tight (but albeit short-lived) couplings at the level of individual projects. In this study, we explore the practice of novation, a method employed within the construction industry of ensuring cognitive consistency and learning within the temporary project network by retaining the services of key actors (such as architects and engineers) at different phases of a construction project. Through interviews conducted with a variety of actors in the construction industry, we define novation, its purpose, and the way in which it may influence learning in networks.

Key words: Novation; Learning; Knowledge; Business Networks; Construction industry.

Novating Knowledge – An Introduction

The purpose of this study is to understand how the alteration of established network structures through 'novation' may help and/or hinder network learning. 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).

Ford and Hakansson (2006) highlight the challenges to traditional views of both business structures and business processes that network and interaction perspectives bring, and note that attempts to examine the characteristics and dimensions of interaction in an economic setting has been limited. They assert that in the new economic logic of value creation only two assets really matter: knowledge and relationships. Novation is seen as a useful way to transfer knowledge between network partners. In addition, it changes network relationship dynamics by bringing external expertise and experience into the contractor's own network. This supports the views of Thirkell (1997), who states that companies create value not only through making their offerings more intelligent, but by making their customers and suppliers more intelligent as well. Novation offers a means of transferring not only explicit knowledge but also the tacit knowledge of the novated individual to the contractor by actually transferring the individual to the contractor's team.

While the transfer of such individuals helps to reduce risk incurred in a project by sustaining consistency of design intent and reducing inefficiencies by reducing the need for re-design, it also presents challenges for the individuals concerned. These challenges often relate to mixed loyalties for those 'novated' (for example, individuals who have moved from the client to the contractor team) and the need to adjust to new network relationships within the overall project network. Such challenges are an increasing part of business-to-business network relationships. In relation to our understanding of learning and knowledge management in the context of value networks, these challenges include the building of a repertoire of knowledge within the network. In addition, they include the collective sharing and interpretation of such knowledge, and the necessity to go beyond the consideration of information dissemination alone to include the consideration of mutual exchanges and interdependencies among learners (Haythornthwaite 2002).

We focus our attention in this study in particular on the social aspects of learning and innovation through the use of novation in construction team networks. In particular, we draw upon cognitive theoretical approaches to understanding network-learning processes (Monge and Contractor, 2003) in order to understand how the shared interpretations that people have for message content (in particular network goals and stories) are developed and maintained within the team. We focus in particular here on the impact which novation may have on the novated individual and their subsequent relationship with the rest of the construction team

network. We ask the question: How does novation affect the social aspects of learning for both the individual and the team?

We then go on to discuss how the structural change of assuming a new network position may influence innovation in construction project teams, and how this may also impact innovation and learning outside the team boundaries (i.e. at the firm and/or industry level). Network structure has been seen to influence processes such an innovation and knowledge sharing (Luke et al., 1989; Weick and Roberts, 1993; Dubois and Gadde, 2002). While some organizations merge with others into tight bureaucratic structures, others enter into more loosely coupled multi-organizational arrangements. In relation to the construction industry, construction projects require tighter coupling in order to manage their greater complexity and interdependence of activities and actions. Dubois and Gadde (2002) describe a project as a specific and temporary (and tightly coupled) network within a more permanent (and loosely coupled) industry network structure. As it is the pattern of couplings (tight and loose) that together characterises a system, this particular embedding of tighter project networks within looser industry coalitions may help explain innovation and knowledge sharing processes within the construction industry. In relation to network structure and coupling, we ask the question: How does novation affect innovation and learning in more tightly and more loosely coupled networks?

We first discuss types of contractual relationships and procurement methods in the construction industry. We then go on to discuss the background literature on cognitive consistency and network coupling. We outline our methodology and the data collected, and then apply inductive analysis of our data to discuss how novation may affect the social aspects of learning at both team and individual levels and how this change in network structure may affect innovation processes and leaning in tight/loose network couplings. We conclude by offering guidance on the use of novation in networks and the implications for managerial practice.

Contract Forms and Procurement in the Construction Industry

Project design and delivery in the construction industry involves a process of increasingly detailed specifications that must be understood and translated into practical building applications by teams of specialist participants. This process is reflected in the standard Royal Institute of British Architects (RIBA) staged design process that outlines eleven key stages in the design and build process. These range from stage A (appraisal, in which identification of client's requirements and of possible constraints on development takes place) through several intermediate stages. These stages include project specification (identifying the key requirements to be met and the organisational structures needed to implement it), preparing outline proposals and estimates of overall costs, to the preparation of final and detailed proposals that can be used to obtain tenders from contractor firms (stage H). The appointment of a contractor who will then undertake the construction of the design and any post completion issues (such as inspections and financial closure) constitute the final RIBA stages (J and K). This classical approach to procurement is known as 'design/bid/build', and requires the design phase to be completed prior to procuring builder services (Molenaar et. al., 1999). It is also known as a one-stage tender, as the contractor will bid giving a final lump-sum cost based on the design brief. Thus, much of the risk and uncertainty of the actual building process may fall to the contractor, who is now legally contracted to a time/price promise.

While this staged process seems simple, in fact many innovative and varied approaches to its implementation have been developed, particularly in public sector procurement (Molenaar et. al. 1999). In particular, various forms of two-staged tender processes are being employed. With a two-stage tender process, the technical proposals are separated from the fixed price. The first stage is to receive technical proposals from qualified contractors and then to short list from these proposals. The shortlisted firms then submit bids that can then be assessed by the client. This model has been taken further to include a more collaborative working partnership between the client and the contractor, known variously as 'concurrent engineering' (Love et. al., 1998), 'enhanced design and build' (Chan, 2000), 'novated design and construct' (Doloi, 2008), or 'develop and construct' (Rawlinson, 2008). This approach recognises the reality that in many two-stage bids the client goes to the market with incomplete design information, and that in conventional two-stage procurement problems may arise because of insufficient integration between the design and construction teams and/or a lack of transparency in the contractor's pricing. The develop and construct procurement route combines elements of two-stage tendering and more collaborative partnering between those involved. This method seeks to reduce the 'procurement gap' identified by Love et al. (1998),

where the separation of the design and construction processes contributes to major behavioural, cultural and organisational differences that then adversely affect project success.

Features of this approach include the appointment of the contractor earlier in the design process (typically at stage C or D rather than stage J), the involvement of subcontractors in design development and pricing, and the use of novation in assigning some or all of the design team over to the contractor prior to the final fixed price being set (Rawlinson, 2008). The main benefits are seen as a fairer allocation of risk between client and contractor, better integration of design and construction though collaborative working, a reduced need for the contractor to employ his own shadow design team (as the clients' design team may be novated to the contractor) and better co-ordination of the work of subcontractors. It is also believed that because risk is more fairly shared (i.e. does not reside solely with the contractor) and because specialist subcontractor pricing can be considered in preparing the final fixed price, this procurement method encourages innovation (Molenaar et al. 1999).

The main drawbacks are the pressure to complete design details quickly once the contractor has been appointed, and the importance of pre-selecting the right contractor and design team members. Success in this respect is reliant not only their technical skills but also on their ability to work together as a team (Rawlinson, 2008). Clients should not overlook the need for team working and the managerial investment needed in facilitating this. In some cases, clients have mistakenly anticipated a lighter administrative burden by employing the expertise of the contractor earlier in the process, but in fact have experienced greater pressures than those expected with one-stage procurements (Molenaar et. al. 1999). In addition, while enhanced team working might be presumed to be an important driver of these new contractual forms, in fact research has shown that often it is the desire for fast track delivery processes that is perceived as being the most important and significant advantage, with better working relationships offering the least important advantage (Chan, 2000).

Cognitive Theory and Network Learning

To help understand how novation relates to 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 it 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).

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. This ability may also be influenced by the allocation of internal resources, and thus power relationships within an organisation will influence the exploitation of new knowledge (Todorova and Durisin 2007). They argue that this ability to see and understand the potential of new external knowledge is the first component of dynamic capability development. This ability could be linked to the work of Harrington and Guimaraes (2005), who point out that knowledge acquisition and assimilation requires a knowledge-sharing culture. In part, network culture is a means through which network members orient themselves to network interactions and activities, and attempt to increase their cognitive consistency. Network culture influences knowledge transformation and exploitation in particular in that the myths, sagas, and stories developed through a common culture impact the network's ability to implement innovations and apply new learning (Harrington and Guimaraes 2005).

In a novated relationship (where the novated member will have been a part of the original client centred design team) this move may well create difficulties for cognitive consistency in the network. In particular, if the contractor desires changes that the novated member feels are not in the best interests of the original design intent and client brief. On the other hand, cognitive similarities between the client and contractor firms should positively influence learning through novation because there is a greater overlap of shared understanding. Because these 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. A lack of relationship enactment at the industry level may well inhibit network learning. We therefore formulate our first research question:

Q1: How does the act of novation ensure cognitive consistency?

Network Coupling and Innovation

Network structures can be characterised by the way in which actors are tightly or loosely coupled (Luke et al. 1989; Weick and Roberts 1993). Consequently, while some organizations merge with others into tight bureaucratic structures, others enter into more loosely coupled multi-organizational arrangements. Loosely coupled arrangements or 'quasi firms' maintain each organization's separate legal identity while at the same time functioning as interdependent wholes.

The extent to which networks are designed to achieve strategic level purposes for their members serves as a means of classifying loosely coupled forms (Luke et al. 1989). Luke et al. (1989) proposed two dimensions for assessing strategic level purposes: that of the 'importance' and that of the 'permanence' of a shared interorganisational purpose. The importance of a particular purpose or goal for each network partner, and the relative time-scale (or long-term orientation) of the network collaboration led Johnston et al. (2006) to propose network coupling as a key question to address in understanding network dynamics. It has been argued that loosely coupled forms are typically found in industries such as construction, where a specialized and autonomous group of workers, a relatively high degree of task complexity, and a high degree of uncertainty come together (Luke et al., 1989; Weick and Roberts, 1993). Dubois and Gadde (2002) argue that at the level of the firm in construction industry networks there is greater localised adaptation to the unique aspects of each project, and consequently this adaptation provides a sensitive sensing mechanism that helps firms to know their environments better as they have access to a variety of information sources and contexts. In a loosely coupled system, there is more room for self-determination and the freedom for actors to deal with problems in a multitude of ways that may encourage variety and innovation.

However, while more long-term and permanent network relationships in the construction industry at the level of the firm may be loosely coupled, at the level of the individual project they exhibit the characteristics of tight coupling (Dubois and Gadde, 2002). This is because specific projects are characterised by time sensitivity, the need to perform and coordinate activities sequentially, and involve specialised actors. Projects therefore require tighter coupling in order to manage their greater complexity and interdependence of activities and actions. Dubois and Gadde (2002) describe a project as a specific and temporary (and tightly coupled) network within a more permanent (and loosely coupled) industry network structure.

The fact that project teams are able to develop tight couplings is related to their identity as communities of practice. Such communities of practice tend to promote collective knowledge, shared sense-making and distributed understanding (Dubois and Gadde, 2002). The importance of the regulatory system in relation to health and safety in the construction industry both exemplifies and contributes to reinforcing these aspects of their community of practice. Thus tightly coupled structures may well reinforce and encourage cognitive consistency for those individuals within the network. The industry is seeing new contracting forms and a desire for closer relationships between network partners, such as develop and construct, which seeks to create tighter couplings between firms. However, the attempt to move away from short-term and tender based approaches to project network formation does challenge the established norms of the community of practice in the construction industry (Dubois and Gadde, 2002) and present a challenge to cognitive consistency. We therefore formulate our second research question:

Q2: What are the implications for network coupling and innovation of novation?

Methodology

Case study selection and context

Against the foregoing discussion, we aim to understand how the alteration of established network structures through novation 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 (Cox and Thompson 2002), 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 (i.e. novation) given these circumstances would seem valuable.

The two case studies were similar in that they both utilised the 'develop and construct' procurement method, and both projects novated some design team individuals to the contractor's team. Case study one was a project creating office space and conference and training facilities. The second case related to the construction of a combined heat and power plant (CHP) for a large-scale institutional user. 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.

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 that collectively possessed in excess of two hundred years' experience in the construction industry. The interviews lasted on average 90 minutes and were digitally recorded and transcribed verbatim. Some forty hours' of interviews were recorded leading to more than two-hundred and forty pages of transcribed data. The theme of the discussions focused on the acquisition, interpretation, dissemination and utilisation of knowledge within the network.

In the construction industry, novation is used as a means of transferring knowledge (and the knowledgeable party) to the contractor team, and results in material changes to 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.

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 interpretavist 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).

Analysis

The network pictures and the interview data were analysed to identify relevant insights relating to our two research questions, and to identify the factors that facilitate or attenuate successful network learning under the transition of novation. A coding schema, based on pattern matching, was inductively developed and employed (cf. Krippendorff 1980). The process of coding the data was conducted independently by two academic judges in order to assess the trustworthiness of the case selection and highlight inconsistencies. In cases of disagreement, both academic judges re-considered the primary data and agreed on an appropriate determination through a process of discussion.

Findings and discussion

Given the paucity of research concerning novation, we initially provide an overview of respondents' perceptions of this undertaking. Novation was seen as being both a common practice in the construction industry and one that was relatively recently adopted: "*Novation is common in the industry, particularly for design and build contracts. It is one of the things that has grown over quite a few years, maybe the last ten or so years*". Under novation, the services of knowledgeable actors (typically the architect) within the temporary project network are retained from the design phase to the build phase: "*At this point, the architect, mechanical engineer and structural engineer are working for the client, to produce the original drawings and specifications, which we have an input into. It gets to the point where the job is priced, it's agreed, and what then happens is this team comes over to our side*". Hence, novation is regarded as a practice that fosters closer network links against a backdrop of loose couplings in the permanent network: "*They* [the novated individual] *then become part of our team almost. It's almost as if we are one big team because you are all working towards a common goal*".

There was a consensus of opinion among respondents that novation was regarded as somewhat of a peculiar practice by industry outsiders but an approach that was effective: "*It's a funny relationship, novation …* [it] *works better than perhaps logically you would assume it would. It is a way of working that people in the industry are used to*", and that it "*…generally works quite well*". Constituting a legal agreement, novation was not reserved exclusively for architects, with a number of key actors being novated: "*We have novated the civil engineer, the structural engineer, the architect, the mechanical engineer and the electrical engineer*".

Novation and Cognitive Consistency

Merali (2000) maintained that it is in the formation of collective schema that collective consciousness is supported and learning facilitated; hence, the extent to which an individual and the collective have congruent schemata will determine the extent to which the individual is an effective part of the collective. In the process of novation, individuals are transferred to new positions in the network precisely because they may bring their knowledge and experience to alternative network members. 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 it's 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.

As "The pattern of couplings in the construction industry favouring project efficiency is clearly an obstacle to innovation and learning" (Dubois and Gadde 2002, p.630), the 'cognitive consistency' afforded under novation was perceived as its major benefit through the retention of knowledgeable actors at different phases of the project. Consequently, novation is viewed as a response to the complexities faced within the construction industry stemming from what Gidado (1996) describes as the uncertainty inherent in the individual tasks performed and the interdependency between tasks. In this sense, the design and build phases of a project are clearly highly connected and interdependent and it is not uncommon for the original design to lack complete specification in order to execute the design creating significant uncertainties (Dubois and Gadde 2002). However, there is often a learning process to address with develop and construct procurement and its use of 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. 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.

The influence of coherence-driven processes may be so great that it spreads through a chain of intermediate inferences to produce remote changes. Thus, the impact of novation may extend well beyond the individuals most directly involved. In addition, as these processes unfold the tendency to give precedence to one set of beliefs over another (known as constraint-satisfaction) in order to resolve ambiguity and achieve balance takes place (Simon and Holyoak, 2002). Constraint-satisfaction will thus tend to highlight the correlations between cognitions within a particular context. For example, as a court case unfolds the evidence presented is not seen as a series of isolated facts, but as part of an emergent whole which influences the perceptions of the facts themselves such that a decision is reached which is consonant with this emergent whole. As design team members are removed from the core design team and novated to the contractor, the context of their situation changes and thus constraint-satisfaction 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*".

This 'continuity' was regarded as a valuable aid to learning and transferring knowledge given the short-term nature of projects against a backdrop of loose industry couplings: "*You know the team and there is an understanding about how things will work*". Given the absence of complete specification in initial building designs, novation ensures that certain actors (typically architects) have an understanding of how to resolve

this: "*We develop the design in more detail. Things shouldn't really change from the design, but they* [the contractor] *do not have enough information to build from it. Not everything is dimensioned, how things connect to each other is not always resolved, so that's what we do. So, we take things from the tender stage to the construction stage*". Against this, novation was also seen as a means of reducing the learning cycle inherent in circumstances where, *"…if you bring in someone new, then you have to get them to a point where they understand the project and are enthused takes time"*, and "*It is possible to novate all of the consultants and there are benefits in doing that as a new architect or a new structural engineer does not have to relearn the design*".

It was recognised, however, that the learning curve is bidirectional. While novation may enable the transfer of knowledgeable individuals to the contractor's network, they do not come with the experience of working as part of that network that the contractor's own design team would have. This was evidenced in the decisions taken concerning the structure of the network, and reflected an understanding of the novation decision as one that is longer-term in nature: "*There was a decision to be made over whether we would get novated or would* [the contractor] *bring in their own team. We thought at that point that perhaps they needed to bring in their own team who understand how* [the contractor] *work because we hadn't worked with them in this type of way before, but because they started to work as part of the team and be more dedicated to the project we felt more comfortable being novated*".

Novating certain actors was also seen to help to reduce risk in the network characterised by considerable uncertainties. For example, the client is faced with uncertainty in terms of what type of building will actually be constructed (i.e. the variance between the initial design and finished building), while the contractor – having agreed to construct the building within certain cost parameters – has to bear any additional costs (e.g. increases in the costs of raw material supplies, delays, etc.). One contractor reflected on novation under these circumstances: "*We minimise the risk* [for the client] *because we are working more closely with a very knowledgeable team of people who have been novated and have access to information we wouldn't have if they weren't novated to our team and we also have a certain amount of control over how the problem is then resolved*". Further, the absence of novation raised costs for the client where: "*...we will be having two architects at different stages of the project and that will mean paying twice and* [the client] *feels that they would be losing control over the design*".

In contrast, it was recognised that conflicts might exists. 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."*

Our first research question asked how the act of novation might ensure cognitive consistency. From the data, we can see that by novating client team members to the contractor, there is the opportunity to facilitate greater consistency and continuity of design decisions and project intent, to reduce risk and uncertainty, and to enhance productivity. However, these benefits are not a forgone conclusion. There is a learning curve to making novation work, conflict may need to be addressed, and the perception of having to serve two masters by the novated individual may be a serious impediment to successful novation.

The Impact of Novation on Network Configuration: the Network Post-novation

Another rationale for novation is that it facilitates knowledge sharing by embedding individuals in tightly coupled project networks to different network positions, thus loosening the coupling at the project level and allowing knowledge transfer within industry coalitions (thus tightening the coupling at the

interfirm/industry level). As Dubois and Gadde (2002, p.630) note, "It is the pattern of couplings that shapes (and is affected by) the behaviour of the actors", hence the configuration of the network stems from the links between actors as well as the interactions between these actors. 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.

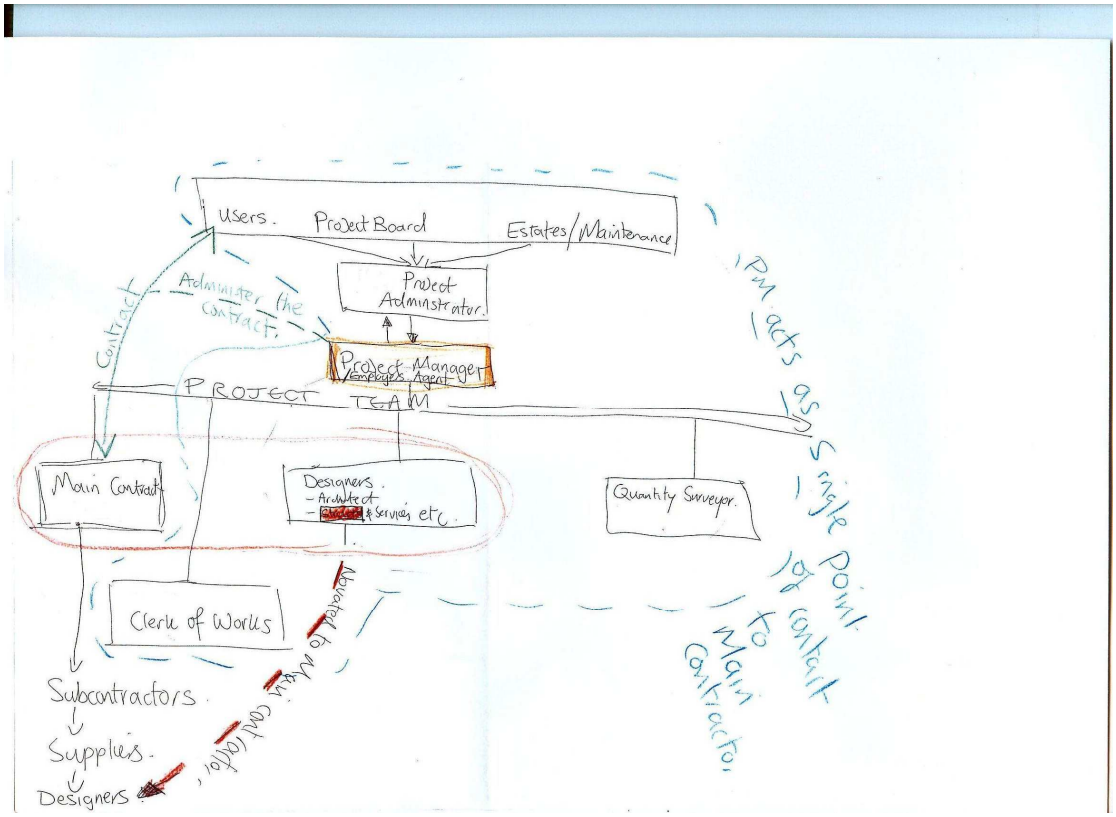

Figure 1 Network Picture

In contrast, in Figure 2 we see the network picture of a novated individual themselves. In this picture, they remain at the centre (the position titled "consultant").

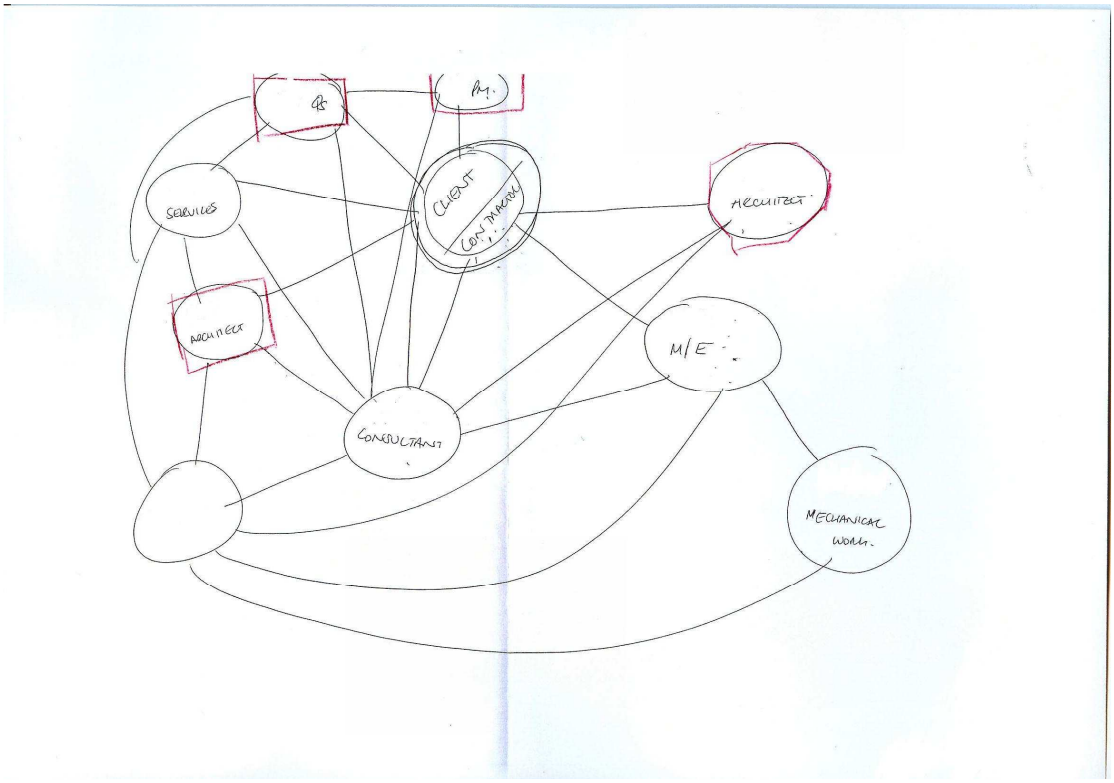

Figure 2 Novated Actor Picture

This self-centric picture of their network is evidenced even prior to novation, where actors recognize that the transition will occur and will affect relations within the network, thus influencing behaviour pre-novation: "*There were concerns on both sides at certain points* [architect and contractor] *that we have a relationship but it is an informal one. At that stage of the relationship what you are thinking about is that they are going to take responsibility for their design and they are thinking 'oh god, we are going to have to work for these people later on', so there is a lot of bridge building*". Remaining self-centric throughout the novation process may be one way in which novated individuals cope with looser couplings as their network position changes.

Respondents were also aware that the reconfiguration of the network post-novation could lead to conflict within the network due to a lack of familiarity between actors: "*Pre-novation you have a clear line of intent between [the client] and us, post-novation you find yourself working for the contractor. There can be a conflict of interests between design and build* [teams]. *All of us on this project who have been novated do a lot of work for* [the client], *so we have an interest in making sure that the relationship continues. We have an interest to make sure that* [the client's] *interests are upheld.*" It was also clear that in addition to potential network conflict, there were tensions about inflated costs due to network reconfiguration and the level of understanding of some actors: "*As soon as novation happens there is a significant change in the contract because we would have severed most if not all of our ability to change the design. If we do change the design it's of great cost to* [the client]. [The client] *is very risk averse. If any major changes are made* [the contractor] *could end up losing money on the project*", and "*They* [the contractor] *were asking questions about the design which we told them would get resolved later. So, there was a lack of understanding at the start which caused some nervousness*". Such issues also paradoxically inhibit network learning as the roles and interactions of project team members are constantly changing and the opportunity to learn from experience in order to improve future similar processes may be more limited (Dubois and Gadde, 2002).

Novation results in looser couplings between some actors at the project level, as noted. Even with these looser couplings between actors, reconfiguring the network has an impact on the loyalties of individual actors. For example, under conditions where an architect is novated from the client (after the design phase) to the contractor (at construction phase), the architects' loyalty should theoretically reside with the contractor. Respondents noted, however, that this was not necessarily the case: "*Their loyalty* [the architect] *at this point is all to the client. Post novation, their loyalty should be to us, but in reality they are still the client's design team. There is nothing they are going to do to upset the client. Their loyalty is always going to stay with the client despite the fact that contractually their loyalty should be to us*", and "*…if the architect's loyalty is to the client, or more often to themselves, you have no control over that despite the fact that you do employ them. It*

is almost impossible to control". These 'cognitive dissimilarities' between network members, compounded by a change of network position post novation, reduce the likelihood of shared understanding and learning even within the context of novation.

Our second research question examined the implication for network coupling and innovation of novation. As it is the pattern of couplings (tight and loose) that together characterises a system, this particular embedding of tighter project networks within looser industry coalitions may help explain the difficulties of innovation and knowledge sharing within the construction industry.

Loose industry coupling presents problems in relation to establishing a learning curve at the individual level, as the roles and interactions of project team members are constantly changing and the opportunity to transfer knowledge to future projects may be limited (Dubois and Gadde, 2002). This is also an issue at the firm and industry levels, as the couplings between activities and learning on different projects may be loose. From the data, we can see that novating client team members to the contractor does raise issues for innovation and learning. Coordination among firms beyond an individual construction project is often compromised as team members are seldom the same from one project to the next. Even under circumstances where actors do happen to work on different projects together they may have new or different roles in relation to each other on each project (Love et al. 1998). Respondents were aware of this and noted that beyond the level of the project: "*We may work with them* [the novated individuals] *and never see them again. So, we don't always get to work with the same people again*". As a consequence, learning and innovation may not spread beyond the project network. Even within the project network, the couplings between actors may also paradoxically be loose. These loose couplings then do not provide a coherent structure in which knowledge and learning is recognised, captured, shared, or understood. For example, respondents did not always posses a clear understanding of what was happening within the network. Asked why a certain actor was not novated, a respondent replied: "*I haven't got a clue*".

Due to construction network relationships potentially changing radically from project to project, the ability of members to form cognitive structures that support learning is problematic (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). They provide greater localised adaptation to the unique aspects of each project, and consequently this adaptation provides a sensitive sensing mechanism that helps firms to know their environments better, as they have access to a variety of information sources and contexts. In a loosely coupled system, there is more room for self-determination and the freedom for actors to deal with problems in a multitude of ways that may encourage variety and innovation. Novation, by loosening the coupling of an otherwise tightly coupled network, helps to encourage innovation but also inhibits learning from such innovation because of the changes in network membership between projects.

Changing the network position of key members of the design team, however, does allow some benefits for learning, and provides expertise to solve problems. *"In a traditional contract if there is something wrong with the design you have a 'variation', which is a change we would make to the design and get paid for it, so a certain amount of risk stays with the client. Because the design team come over to us, the information comes to us, that team becomes ours, the job becomes ours, unless the client asks for things to be changed in the design it becomes less of a risk. People have taken the view that if you don't want any risk it is the best way to approach a job. There is then more risk for us and the novated team because with any job nothing is finalised and there will always be changes [to the design]. If you find that there is a problem it becomes our problem and we pay for it not the client. We minimise the risk because we are working more closely with a very knowledgeable team of people who have been novated and have access to information we wouldn't have if they weren't novated to our team and we also have a certain amount of control over how the problem is then resolved."*

In relation to innovation, novation and the change in control of design team efforts (from the client to the contractor) introduce some interesting dynamics. A common mechanism for encouraging innovation within a project is through the use of incentives. Contractors use incentives to encourage appropriate changes to the processes and materials used in the project: *"We try to set up some incentives for them [the novated architect and structural engineer] to look at the design to see if they can make changes"*. Such incentives are then used to encourage the design team in their new network positions as part of the contractors' team: *"When we set-up their fees we have agreement where they can get a percentage of what ever savings they make in order to try*

to make it attractive to them and to encourage them to be innovative. But this will all still be within the brief. It might actually be the methods of working that change, which saves us time and money."

Conclusions and Implications

The aim of this study was to understand how the alteration of established network structures through novation may help and/or hinder network learning in the construction industry, an industry characterized by short-lived site-specific project-based activity, uncertainty due to a lack of complete specification, and loose couplings in the permanent industry level network – impediments to innovation and learning (Dubois and Gadde, 2002). We focused our attention in particular on the social aspects of learning and innovation through the use of novation in construction team networks. In order to understand these issues better, we draw on two theoretical perspectives. Initially, we drew upon cognitive theoretical approaches to understanding network-learning processes (Monge and Contractor, 2003) in order to understand how the shared interpretations that people have for message content. Secondly, we employed the network coupling and innovation literature in order to understand how the structural change of assuming a new network position may influence innovation in construction project teams, and how this may also impact innovation and learning outside the team boundaries. Against this, we sought to answer two research questions: how does the act of novation ensure cognitive consistency, and what are the implications for network coupling and innovation of novation?

We initially found that novation offers a means of transferring not only explicit knowledge but also the tacit knowledge of the novated individual to the contractor through the act of transferring the individual to the contractor's team. Thus, companies were able to create value not only through making their offerings more intelligent, but also by making their customers and suppliers more intelligent as well (cf. Thirkell, 1997). For our first research question we asked how the act of novation might ensure cognitive consistency. We found that by novating client team members to the contractor, there is the opportunity to facilitate greater cognitive consistency and continuity of design decisions and project intent, whilst reducing risk and uncertainty, and to enhance ultimately productivity. Such benefits were not always attained or easily accomplished. Novation called for actors to manage a steep learning curve in order to make novation work, to manage conflict in the project network, and the perception of having to serve two masters, all of which may act as a serious impediment to successful novation and network learning.

Our second research question addressed the implication for network coupling and innovation of novation. As it is the pattern of couplings (tight and loose) that together characterises a system, this particular embedding of tighter project networks within looser industry coalitions may help explain the difficulties of innovation and knowledge sharing within the construction industry. Loose industry coupling presents problems in relation to establishing a learning curve at the individual level, as the roles and interactions of project team members are constantly changing and the opportunity to transfer knowledge to future projects may be limited. This is also an issue at the firm and industry levels, as the couplings between activities and learning on different projects may be loose. We found that novating client team members to the contractor does raise issues for innovation and learning. Coordination among firms beyond an individual construction project is often compromised as team members are seldom the same from one project to the next. Even under circumstances where actors do happen to work on different projects together they may have new or different roles in relation to each other on each project. Consequently, learning and innovation may not spread beyond the project network, as even within the project network, the couplings between actors may also paradoxically be loose. These loose couplings then do not provide a coherent structure in which knowledge and learning is recognised, captured, shared, or understood. Therefore, by loosening the coupling of an otherwise tightly coupled network, novation helps to encourage innovation but also simultaneously inhibits learning from such innovation due to the changes in network membership between projects.

The construction industry is seeing new contracting forms and a desire for closer relationships between network partners, such as develop and construct, which seeks to create tighter couplings between firms at the level of the project. The attempt to move away from short-term and tender based approaches to project network formation does however, challenge the established norms of practice in the construction industry (Dubois and Gadde, 2002) and present a challenge to learning and innovation for both individuals and the industry as a whole. By understanding the practice of novation better, managers within the industry and their clients may hope to improve its usefulness as a means of knowledge transfer and as a conduit to innovation. In the present study we have identified the practice of novation as an important means of knowledge transfer

and the sharing and reduction of risk in construction networks. We have explored the impact of novation, both positive and negative, upon cognitive consistency, network structure dynamics, and learning and innovation in the network.

Doloi (2008) identified several factors that proved significant in the success of novated procurement designs. These included the client's involvements in post novation design, selection of the design team, morale in post novation, the relationship between contractor and design team, and expertise of novation within the design team. We have seen examples of how efforts to gain cognitive consistency and realign network structures may rely on some or all of these factors. The involvement of the client – both pre and post novation - is critical in developing consistency in the schemata which network member then adopt and enact. Proactive steps to reduce cognitive inconsistency, i.e. actions such as team building and shared communication practices, allow relationship enactment to enhance cognitive consistency post novation and reduce stress for the novated individuals. The selection of design team members, their relationship with the contractor (both pre and post novation), and the experience that network members have of the novation process; all may influence the way in which novated individuals deal with their change in network position. When supported well, consistency of the clients' design intent and more readily avialable design expertise of the project to the contractor may be important benefits of the novation process. However, where design team members do not experience cognitive consistency in their work with the contractor, and thus their actions may stem from miss-understandings (i.e. constraint-satisfaction behaviours) novation may bring problems. In addition, novation entails a two way learning curve between the novated individuals and the contractors' team

Network reconfiguration through novation has implications for innovation and learning. At the level of the individual, remaining self-centric throughout the novation process may be one way in which novated they cope with looser couplings as their network position changes. However, this may also inhibit learning and innovation at the level of the individual. In addition, looser coupling (by altering their network position) may present problems for learning as the roles and interactions of project team members are constantly changing and the opportunity to learn from experience and improve future similar process may be more limited.

This is also an issue at the firm and industry levels, as these loose couplings then do not provide a coherent structure in which knowledge and learning is recognised, captured, shared, or understood within and between firms. As a consequence, learning innovation may not spread beyond the project network. Therefore, by loosening the coupling of an otherwise tightly coupled network, novation helps to encourage innovation but also inhibits learning from such innovation because of the changes in network membership between projects.

In addition to the construction industry, industries with similar characteristics (short-lived projects, extreme uncertainty, and loose couplings in the permanent industry level network), may stand to learn from the experiences of the construction sector and the impediments to innovation and learning they face, particularly as network structure has been seen to influence processes such an innovation and knowledge sharing (Luke et al., 1989; Weick and Roberts, 1993; Dubois and Gadde, 2002).

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 a little known practice outside the construction industry, the issues raised should be of interest to researchers in the area of knowledge transfer and innovation. The data collected and presented in this paper should be of value in guiding further empirical research in these areas.

The industry is seeing new contracting forms and a desire for closer relationships between network partners, such as develop and construct, which seeks to create tighter couplings between firms. However, the attempt to move away from short-term and tender based approaches to project network formation does challenge the established norms in the construction industry and presents a challenge to learning and innovation for both individuals and the industry as a whole. By understanding the practice of novation better, managers within the industry and their clients may hope to improve its usefulness as a means of knowledge transfer and as a conduit to innovation.

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