

INCENTIVISING PROCESS INNOVATION IN CONSTRUCTION SUPPLY CHAIN: THE FORMAL COMMUNICATION STRUCTURE

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Abstract

The UK construction and building services sector is under pressure to engender the culture of innovation and incentivisation as normal working practice in the delivery of 'flexible' and 'complex' infrastructures. The research aims to understand the role of contracts in the incentivisation of performance and particularly the diffusion of innovation in construction supply chains, which is not well understood. Adopting an exploratory, multi-method case study of an NHS-procured hospital; the contract structure, communication network and organisation analysis frameworks are used to explore the extent to which tendering and contractual provision provide the space and freedom that encourages or hinders the emergence, communication and implementation of innovative products and practices. The main findings demonstrate the innovative role of the specialist contractor; identifies the limitations of the formal structure; and emphasizes the role of power in the incentivisation of informal communication in the effectiveness and the diffusion of process innovation.

Keywords: communication network, contract, incentivisation, construction supply chain, innovation

1.0 Introduction: A Healthcare Delivery Perspective

The significance of UK's National Health Service (NHS) cannot be overemphasized. The NHS aims to provide healthcare for all, free at the point of need. Proposed investments within NHS estates in the UK are in excess of £70 billion (NHS 1999). The impact of frequent changes in policies and healthcare technologies on the adaptability and performance of these infrastructures cannot be overemphasized (Barlow and Koberle-Gaiser 2008). The Private Finance Initiative (PFI) which is one of the preferred procurement models of the NHS since the late 1990s have been under scrutiny, but the question being asked in recent times is whether the PFI procurement model has

delivered on its promises¹? Evidence from the literature suggests that there is a divided consensus on the potential role of PFI to enable effective diffusion of innovation (Carrillo *et al.* 2006, Ball *et al.* 2001). Further, there is an inherent conflict among construction and building services actors about what adaptability and innovation means to the delivery supply chain. Barlow and Koberle-Gaiser (2008) investigated the relationship between PFI and innovation in the design of healthcare infrastructure to enable future adaptability but did not recognize that lessons too can be learnt from the interplay between the

¹ Inject innovation into the healthcare sector; contractual arrangements that would ensure better facilities management; means of renewing NHS facilities faster (Barlow and Koberle-Gaiser 2008).

formal and informal communications within PFI and non-PFI procurement models in recommending a shift towards 'smart PFI'.

The intangibility of innovation makes drafting contract clauses to encourage innovation/ incentivise innovation and creativity very difficult. Furthermore, it is not clear whether incentivisation could be passed through the supply chain without compromising the position (in terms of benefit) of the most important players in the procurement process. Thus, the focus of this research is to understand the relative contractual provision within construction procurement models that incentivise innovative practices and its diffusion in construction supply chains. In other words,

2.0 Innovation, Creativity and Incentives in Construction Supply Chains

The driving forces of global innovation could explain why the word innovation is given attention by all regardless of us not knowing what it means. The most straightforward definition of innovation is that innovation is technical and organizational change (Gann 2003). A more widely accepted definition – "...the actual use of a nontrivial change and improvement in a process, product, or systems that is novel to the institution developing the change" is offered by Slaughter (1998). However, the study of innovation predates the late 1960s (Gann 2003), yet the key benefits of innovation as a driver for business competitiveness, quality and productivity improvements and, ultimately, economic growth, is largely only 'thought of' and not 'exploited' by most sectors in practice. The manufacturing sector is often portrayed as a good example of the latter, where creativity and innovation are increasingly driving the boundaries of performance ((see Ernst and Kim 2002), Stein 1991); this compliments the argument that manufacturers invest more in research and development of 'creativity' than contractors and consultants (Gann 1977).

to what extent does tendering and contractual provision provide the space and freedom that allows organizations to encourage or hinder the emergence, communication and implementation of innovative design products and services? Contract interfaces in the construction supply chain will be explored to examine how construction clients, contractors, designers, manufacturers and suppliers are motivated to improve the performance of products and services they procure and provide. The evidence to be collected will be on incentives, creativity, organisational behavior in the context of behavioural economics and the interrelationship (formal and informal) between network actors within and across organizations.

Where, creativity is the ability to create something novel and appropriate (Amabile and Khaire 2008), while innovation is the successful implementation of creative ideas (Eaton *et al.* 2006).

Evidence from main stream management literature however contends that whilst creativity has long been the focus of academics in fields ranging from anthropology to neuroscience; the role of the creative leader which is not well understood is key to imbibing and sustaining the culture of creativeness as normal business in organisations. Drawing on a colloquium to help make the connection between theory and practice, Amabile and Khaire (2008) proposed a manager's guide for harnessing organisational creativity and innovativeness; but emphasized the implication of adopting and not incentivising the context which creativity and the role of leaders bring to bear in increasing innovation. Notably, most managers too often believe in the redemptive power of rewards (Kohn 1993). In other words, they strap compensation to one index of performance without examining the belief

that people will do a better job if they have been promised some sort of incentive. Drawing on behaviourist theory, commentators argue incentive programmes correlates with extrinsic motivators (incentives do not alter the attitudes that underlie our behaviour) while rewards (the intrinsic motivator) do not create a lasting commitment. They merely and temporarily change what we do. Consequently, the success or failure of either extrinsic or intrinsic motivation is dependent on the premise behind it (Kohn 1993).

To this end, the widespread perception that the construction industry performs badly compared to other industrial sectors (Winch 2003) may suggest that the construction industry is less proactive and more reactive in adopting the culture of innovation. Fragmented supply chains and the existing divide between academia and industries have been identified as inhibitors to innovation adoption in the construction sector (Dulaimi *et al.* 2002). Other commentators argue that this could be remedied through the proactive influence of clients and manufacturers (Manley 2008, Brandon and Lu 2008). In particular, Barlow (2000), without emphasising the likely influence of power shift among construction actors, reported that clients have enormous capacity to encourage innovation diffusion amid integrated working practices, which Manley and Marceau (2002) argue can be cultivated by clients' demand for 'total package' solutions.

Several reports spearheading calls for change (Banwell 1964, Higgins and Jessop 1965, Crichton 1966, Latham 1994, Egan 1998) have also drawn attention to the inherent difficulties caused by the organizational systems and contractual arrangements in which the construction process operates. In particular, Latham and Egan reports have called for cultural change in the way construction work is procured in the UK. However, most research efforts still lay emphasis on cost, time and quality

rhetoric during project planning and little consideration is given to the impact of engaging the right or wrong procurement strategy. For example, it has been shown that there is a direct correlation between procurement methods and risk allocation (See Murdoch and Hughes 2007 81-99). In other words, construction and building services actors respond to the allocation of risk differently. In addition, the apportioning of risk up and down the supply chain has a strong bearing on the diffusion of innovative design, products and services (Brandon and Lu 2008).

Overall, there are limited studies that draw on the lessons of other Public Private Partnership (PPP) procurement models, such as Local Improvement Finance Trust (LIFT); and what incentives are used in construction contracts for effective delivery of work packages in the supply chain. We need to understand what contractual or non-contractual incentives and rewards are used for incentivising effective delivery, and how are incentivisation and process innovation facilitated or inhibited in the construction supply chain.

The focus on the recurring question in construction contracting of "how to get people to improve their performance" is gradually shifting to that of "what kinds of incentives are in use in the construction sector" (Hughes *et al.*, 2006 and 2008). In other words, what motivates construction participants to innovate throughout the supply chain? Notably, Hughes *et al.*, (2008) have argued without distinguishing clearly between rewards and incentives that the term incentives is better investigated by contextualising its economic, relational, legal, and psychological perspectives, which may be associated with monetary and non-monetary incentives, contractual incentives and extra-contractual incentives. Though, these contributions (including Hoag and Gunderson 2005, Hoag 2008) on the economic perspective have enlivened the

discussion on incentivisation in the construction sector; nevertheless there is need to understand the NHS's organisational structure which Lockhart (2008) argue are potentially significant barriers for stimulating the incentivisation

3.0 Research Method

This is an exploratory, multi-method case study of an NHS-procured hospital. The unit of analysis is the contractual interface, of which there are hundreds in a typical case. Based on open, unstructured interviews and documentary analysis, the study attempts to map and describe all of the interfaces which provide an analysis of the organisational behaviour and structure of the different construction procurement models. Interview data were reviewed to compare the perceptions of data subjects in relation to contract types, interfaces, supply chain management experience and meaning of innovation. Social Network Analysis (SNA) was be used to identify and analyse the "informal" relationships in the construction supply chain. In other words, the data was analysed through a combination of template and content analysis, and graphical representation of contractual, organisational and communication structures. A combination of purposeful sampling and probability sampling (random and opportunistic) where used in the selection of participants and case (NHS-procured hospital) for achieving the thrust of the research. Purposeful sampling is suitable strategy for the purpose of in-depth understanding inquiry in qualitative research (Patton 1990; Maxwell 1996). In contrast probability sampling depends on selecting a truly random and statistically representative sample for the purpose of generalization in qualitative research. Opportunistic sampling was used to follow new leads during field work. A total of 30 open, unstructured interviews were conducted. The average interview time lasted 90 minutes. Interviewees were UK

and diffusion of innovation. Furthermore, Hughes *et al* (2008) was also of the view that there is almost no recognition of the extended supply chains amongst the range of papers reviewed about incentivisation of performance.

wide construction actors (clients, manufacturers, suppliers, main contractors, specialist contractors and sub contractors) who operate in the healthcare, housing, roads and education sectors. The interview transcript where analysed for evidence and construction industry classification of innovation ideas, communication and diffusion of innovation, and contractual and non-contractual incentives up and down the supply chain. A qualitative software package (Nvivo 8) was used for the data coding process. UCINET² 6.220 was used in the analysis and mapping of nodes (Borgatti *et al* 2002). The units of analysis (contract interface and organisational behaviour) were clearly identified and defined in the context of their interaction with the social networks, organisational structures and contract structures. The initial template (see Appendix 1) which was developed to reveal and cluster all interviewees' responses resulted in 118 preliminary codes.

² This is a software package used to aid the analysis of the captured social network data. Social network analyst use a specialized language for describing the structure and contents of the sets of observations they represent.

4.0 Exploratory Study

The interviewees which include clients, manufacturers, main contractors, specialist contractors, sub contractors and suppliers have an average work package that range between £10s of thousands and £100s of millions. Framework agreement, competitive tendering, sub contracting and partnering were their main method of selection. The methods of contracting deployed encompassed management contracting, design and build, general contracting, novated design and build, package deals and relational contracting. Price based on work, price based on value, services paid at point of delivery, shadow tools and unitary charges were amongst the host of pricing mechanisms detected. Key Performance Indicators (KPI) was a

4.1. Case Study

This is a short case study of a PFI-procured hospital. No informal background interviews of domain experts were required. The participants were senior representatives from the Department of Health, design project manager, the general manager, construction project manager and architect. We are required to maintain confidentiality over the location of this hospital. The research included semi-structured interviews and analysis of background documentary materials. The data collection exercise spanned a 12 month period in the second quarter of 2007 and half of 2008.

5.0 Findings and Analysis

There are three ways of looking at construction projects: organisational structure, contract structure, and informal relationships. Organisational structure portrays the formal relationship within and around the organisation. For instance, organisational structure of the client includes not only people within the regional health authority involved in the project but also many professionals acting as consultants in the project. Outside the

commonplace in the data analysis. KPI is also used to determine the strategic members of the supply chain. In other words, there were cases where clients were subjected to KPI measures. However, it is not sufficient to completely depend on the outputs of these quantitative measures without considering qualitative measures in view of the fact that studies have shown they do not compliment (comparatively) each other (Jenkins 1986). Interviewees were at the top end of the organisational structure (directors, project managers, supply chain managers, procurement directors. The interesting thing here was that interviewees were able to draw on firsthand experience of completed and ongoing projects.

The attribute of this hospital is best described as urban site with flexible and specialist ward layouts developed for the innovative service delivery model of 'graduated care'. The criterion for selecting the hospital used for this case study is based on an example of an adoptable and innovative PFI scheme. All interviewees were assured of confidentiality to elicit as much unrestricted information as possible. A major constrain of this retrospective case study was that key actors and stakeholders who were part of the construction supply chain were inaccessible.

organisation, there are different professionals and suppliers who are involved in the project, as well. Consultants act as the interface mediating between the client and the supply chain. This makes communication difficult and complicated and has a significant impact on decision-making in terms of time-consuming and available options because architects/consultants often make decisions for the client. Although the formal organisational structure should be reflected by the

contract structure, it is difficult to formalize the complex multi-party relationships within a multi-organisational project through contractual arrangements, especially as they involve a less formal structure. These difficulties give rise to the need for understanding the communication network and informal relationships that makes a multi-organisational structure function. Contracts tie people together because they are given obligations and rights. Once people are tied in, communications may occur between them and other people who are related to their work, even if not directly related through contract. Although

5.1. What Innovative Procurement Means to Practitioners?

Innovative procurement in the context of this research is either innovative approaches to procurement or procurement approaches to encourage innovation. There are different types of innovation. Most commentators focus on various aspects of technological innovation. The trend is now shifting towards exploring other forms of innovation, such as, process innovation (Pisano 1996); technical innovations (Henderson and Clark 1990, Utterback 1994); service innovation (Gallonj and Weinstein 1996); management innovation (Birkinshaw *et al*/2008); strategic innovation (Hamel 1998, Markides 1997). In other words, the different actors in the construction procurement process ascribe relatively skewed meanings to the concept of innovative procurement, which is not helpful in understanding incentivisation of innovative practices up and down the construction supply chains; particularly in the context of relationships between organisational structures, contract structure and informal networks. Following the data analysis, the client's perception of

5.1.1 Power, Innovation Adoption and Generalizability

communication occurs between people rather than between institutions there was insufficient evidence to suggest that organisational institutions or roles have no influence on the communication networks.

Consequently, the remainder of the analysis and findings are grouped to address the research thrust of how do the contracts that we use currently incentivise creativity, performance and innovation and what kind of changes could be introduced in contracts to incentivise creativity, performance and innovation.

what innovation means was best captured as something which works *"...we did obviously give a lot of input and a lot of steer to what we thought worked well for us now and we therefore, led them to examples of what we thought worked well to show them that and say, "Well, this works well for us, you know, can you replicate that? IN2 Line :98 Col 17"*. Notably, clients saw themselves as drivers of innovation but their wielding power is diluted down the supply chain regardless of the client's willingness to engage. For example, at early stages, it is the client's prerogative to proceed or withdraw from the development. They can also decide whether or not to appoint a contractor. In the private sector, the client has absolute power until the appointment of designers, at which point power shifts to the designers. However, in the public sector, the client may have less power, because of an overriding need to proceed with the development. Evidence suggested that contracts give people obligations, but sometimes forget that they give them rights as well. Contractors who are already on site have a right to continue to do the work, and this cannot easily be taken away.

Questions were raised about whether there are differences in terms of using power between management innovation adoption

and technical innovation adoption. Management innovation is often more radical than technical innovation, which is why management innovation is more likely to involve conflict and use of power. However, it is also argued that technical innovation can trigger management innovation in an organisation. This indicates that technical innovation adoption is not always necessarily associated with less conflict and exercise of power. All of these depend on the nature of the innovation adopted and, therefore, it is difficult to generalize. The role of the architect in the context of innovation adoption was also questioned. Emerging evidence suggests that innovation is not always necessarily going to cost more. Innovation could cost

5.2. Incentives, Contracts and Performance

Evidence of direct incentives for people who do the work is rare in practice. There were no standard incentives in the various procurement models for incentivising innovative practices. However, there were traces of intuitive organisational practices and behaviours (such as repeat businesses, open book contracting, continuity of demand and league table contracting) which could encourage innovative practices. The benefits of incentivising the construction supply chain were also acknowledged. In other words, there needs to be a proper mechanism to incentivise individuals to improve their performance or adopt innovation. It is also very important to have a more reliable method for measuring performance. Notably, performance not only depends on buildings and facilities but also on the hospital management, the teams, the skills and the culture. The healthcare industry needs to bring more

5.3 Content Analysis

In order to support the validity and reliability of inferences in the preceding sub sections, a qualitative content analysis - which is a set of systematic and transparent procedures

less and be more efficient. Thus, it can be argued that innovation adoption during the procurement process is difficult due to the complexity of proving the cost of impacts on a project. The power resides with the client initially and the power slowly ebbs away until the contractor is appointed. Clients, these days, have almost no power because contractors have experienced consultants looking after their interests. So clients need advice and support to make sure they will get what they originally asked for. On the whole there seems to be a relationship between power and risk. Projects where clients take responsibility for risk showed traces of innovation, and projects where clients transfer risk are less innovative.

people into the sector and train them to reduce the building projects' dependency on the expertise of a small group.

The role of contracts in the incentivisation of innovative practices is rare. There are evidence of few incentives for performance and innovation in contracts, with little opportunity to incentivise innovation if there is no reward for the contractor to complete ahead of schedule. This is based on the premise that there is a link between innovation and a project which is delivered on time and to budget. However, contract could be performance-based, but outsourcing tends to be price-based rather than performance-based. Despite elements in the contract that aim to ensure the whole life performance of a facility, it is difficult to achieve satisfactory performance in public sector projects and to divorce the team's performance from the facility's performance.

for processing data (Tesch 1990) - was performed with the aid of qualitative software package (NVivo 8). Table 1 is a capture of the average number of times these construction and building services

actors referenced the list of selected variables. Notably the client and manufacturer who repeatedly used the word 'innovation' in the context of our earlier definition failed to provide examples of known innovations. This may provide a partial explanation as to why clients perceive replication as innovation. Drawing on the above described innovative characteristics of the specialist contractor, it can be argued that there is correlation between the specialist contractor's innovativeness and number of examples of

5.4. The Formal and Informal Communication Structure

The informal communication was captured using Social Network Analysis (SNA). SNA is particularly good for investigating issues as diverse as contractual relationships to capture a finite set or sets of actors and the relation or relations between them (Wasserman and Faust 1994). Each node depicts an actor in the construction supply chain. Nodes usually comprise of individuals or firms. In Figure 1 the relation (social ties) between nodes is expressed in lending or borrowing, information and knowledge share. Each of these nodes have

5.4.1 Data Analysis: UCINET 6.220

The captured informal networks data was analysed using UCINET 6.220. This is a program designed to analyse social networks and other proximity data which includes measures of centrality and connectivity, methods of detecting patterns and positions (Pryke 2004). In analysis of the data sets for the six construction and building services actors, patterns and easily detectable variations in values were observable through inspection of the measure of prominence of a given actor within the network (point of centrality). The resulting sociogram diagram (Figure 1) was produced through the 'NetDraw' feature within UCINET. First the data presented in

innovation referenced. Interestingly, the specialist contractor had the least number of references in relation to the variable "information diffusion". This is regardless of the fact that information diffusion is considered a key attribute of innovative practices. A logical explanation which emerged from further analysis suggests the specialist contractor operated a highly integrated supply chain. The specialist contractor even considers the Bank as member of its integrated supply chain.

a pattern of network communication relative to the construction supply chain that is somewhat disconnected from the client and the funding structure. A two way relation between actors is indicated by a double head arrow. The specialist contractor is seen to exhibit a unique pattern of network communication. A pattern that is innovative. The manufacturer's node is inactive. An inactive pattern inhibits innovative tendencies. Figure 1 captures the informal communication network without the redundant node. Figure 2, which is a transpose of Figure 1, depicts a rigid formal contractual structure.

tabulated form. Notably interpretation of the data is linked with centrality and power because power is a fundamental property of social structures (Hanneman and Riddle 2005).

A moment inspection of the sociodiagram (Figure 1) suggests the specialist contractor has a highly "favoured" structural position (see Eisingerich *et al* 2010). For example, this means that 'information' which is one of the strongest variables for pricing risk and achieving heightened client satisfaction is accessible (Winch 2010). More importantly, this 'information' is largely compromised in a more formal structure because of its rigidity. When compared, Figure 2, which is

a transpose of Figure 1 highlights an information dependency structure. The position of the manufacturer (Figure 2) is most compromised. This may be explained computing the centrality of measure between nodes (degree, betweenness and closeness) in Table 2.

Degree: it can be seen from Figure 1 that the specialist contractor has more opportunities and alternatives than other actors in the procurement process. If the supplier elects to not provide a resource, the specialist contractor has a number of other places to go get it; however, if the supplier elects to not exchange resources with the manufacturer, then the manufacturer will not be able to exchange all. The more ties an actor has then, the more power they may have. In Figure 1, the specialist contractor has the highest degree (degree 5). The lowest degree is shared by the manufacturer, client and sub contractor. This logic underlies measures of centrality

6.0 Conclusion

Process and technological innovations are associated with operational roles and activities. The need to capture what this means in the language of construction industry actors cannot be overemphasized, particularly when the role of contract in the incentivisation of innovative practices in construction supply chain is not well understood. Drawing on an exploratory, multi-method case study of an NHS procured hospital there are sufficient evidence to contend that client's perception of what innovation means – innovation as a replication and not as an invention - is skewed. The client's power to drive innovative practices down the supply chain is diluted. Interestingly, the specialist contractor is seen to be exhibiting innovative practices that should be incentivised at all phases of any procurement model. In other words,

and power based on actor degrees. Now consider Figure 2 in terms of degree, each actor (excluding client) has exactly the same number of resources; and the client is least "favoured" in the formal contractual structure. This finding compliments the argument that the clients' wielding power is diluted beyond the first tier of the construction supply chain.

Closeness: the second reason why the specialist contractor is seen to be more powerful (innovative) is that the specialist contractor is closer to more actors than any other actor in the procurement process. Power can be exerted by direct bargaining and exchange. But power also comes from acting as a "reference point" (Hannemen and Riddle 2005).

Betweenness: the third reason as to why the specialist contractor is advantaged in Figure 1 is because this actor lies between every other pair.

management and strategic thinking are heavily linked to control roles and activities. Actors are able to wield power in order to influence information flow within and across boundaries. Consequently, the link between its effectiveness and the diffusion of process innovation can be sustained by incentivising the institutionalization of informal communication networks. This includes a loosely coupled organisation, a client that is able to distinguish between replication and invention, a client that wields power past the first tier of the construction supply chain, a contract structure that integrates the pursuit of a common goal (supply chain) and a client that is prepared to understand the organisational structure and imbibe the innovative practices of the specialist contractor. The issue of generalizability, which was considered as a limitation, was addressed using content analysis; and the number of open, unstructured interviews is determined by the research strategy – this is

an exploratory, multi-method case study of an NHS-procured hospital. More importantly, the contribution to practice will enable providers of health care to motivate those who deliver infrastructure by establishing reward systems that motivate and reward them to think about the impact of each part of the process on the effective delivery of health care. At a regional level, this would enable integrated purchasing

departments to develop clear practical solutions to the development of their specific supply chain partners. At a national level, guidance and policy can be provided about how the procurement of infrastructure should be arranged, and at the international level, general policy guidelines can be published that place the UK at the forefront of policy developments in this arena.

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Appendix 1

- 1 INNOVATION
 - 1 Definition – actors’ perception of what innovation is
 - a. Value engineering
 - i. Examples of innovation
 - 2 Client’s role in driving innovation
 - a. Encouraging new ideas
 - i. Open book contracting agreements
 - ii. Performance
 - iii. Repeat business
 - iv. Framework agreements
 - b. Resistance to innovation
 - i. Client’s as an inhibitor
 1. Contractual liability
 - ii. Cost and targets as inhibitors
 - iii. Funding requirement as inhibitor
 - iv. Quantifiable impacts as inhibitor
 - v. PFI as an inhibitor
 - vi. Risk as an inhibitor
 - 3 Incentivisation of Innovation (encouraging innovative practices)
 - a. Monetary
 - i. Payment
 1. Standard rates
 - b. Non-monetary
 - i. Penalty schemes
 - ii. Achieving Zero defects
 - c. Tendering
 - i. Two stage tendering
 - d. Continuity of demand
 - e. Prompt payments
 - 4 Innovative practices
 - a. Package Closeout Report (PCR)
 - b. Supply chain management
 - 5 Risks associated with innovation
 - a. Diffused through contractual liability
 - 6 Innovation diffusion
 - a. Knowledge management
 - i. Information diffusion
 1. Through framework agreements
 2. Through the supply chain
 3. Networking
 - b. Knowledge creation across boundaries
 - c. Impact on the construction processes (moving ideas into practice)
- 2 PROCUREMENT
 - 7 Contract
 - a. Role of Contract
 - i. Implication of unclear contractual clauses and phrases
 1. Section 106 (whole life costing)
 - ii. Barriers to contract efficiency
 - b. Contract Types
 - i. Relational
 1. Collaborative work
 - ii. Traditional
 - iii. Package deals
 - iv. PFI
 - c. Contractor selection patterns (Tendering)
 - i. OJEU (Framework agreement)
 - ii. Competitive tendering
 - iii. Supply chain (preferred bidder)
 - iv. Negotiation
 - v. Partnering
 - vi. Track records
 - d. Contractual structure
 - i. Contractual option
 - ii. Contractual provision
- 3 ORGANISATIONAL ANALYSIS
 - 8 Specialisation
 - 9 Co-ordination
 - 10 Boundaries between actors and/or participants
 - 11 Interfaces and control of work
 - 12 Structure

Appendix 1 – Contd...

4	ORGANISATIONAL BEHAVIOUR
25	Power <ul style="list-style-type: none"> a. Decision <ul style="list-style-type: none"> i. Policy decision ii. Tactical decision iii. Strategy decision
26	Leadership
27	Motivation
28	Structure of the organisation
5	CONSTRUCTION SUPPLY CHAINS (responsibility for management)
1	1 ST Tier Customer (client) <ul style="list-style-type: none"> a. Satisfaction
2	Focal Organisation (architects, service engineers, structural engineers, QS, design engineer)
3	1 ST Tier Supplier
4	2 ND Tier Supplier
5	3 RD Tier Supplier
6	Last Customer (end user) <ul style="list-style-type: none"> a. Satisfaction
6	SERVICE DELIVERY
1	Improving patient experiences <ul style="list-style-type: none"> i. Patient journey ii. Challenges associated with care pathways as a drive for innovation (Care pathway challenges) iii. Product and services

Figure 1: Informal communication networks

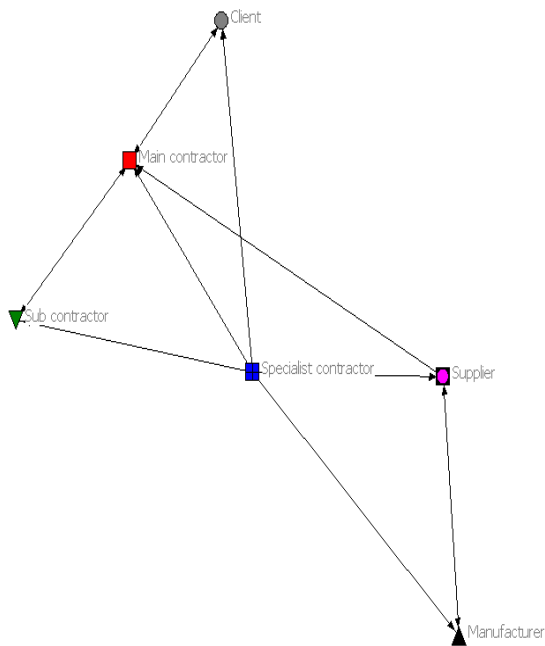


Figure 2: A transpose of the informal communication networks

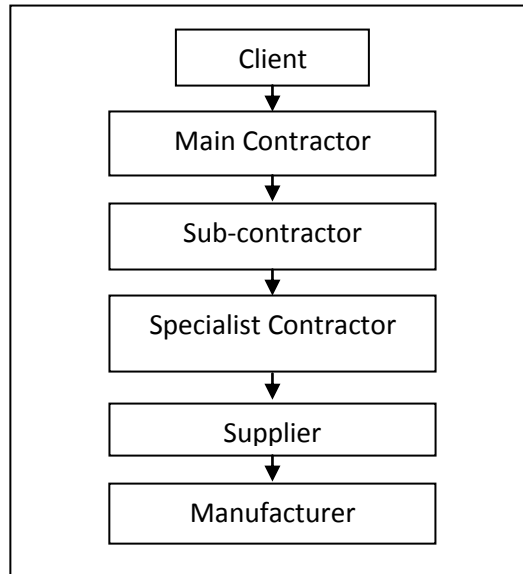


Table 1: Average number of references against selected variables

	Content Analysis						
	Information Diffusion	Innovation Innovative Practices	Relational contracting	Continuous Improvement	Examples of Innovation		
Client	9	15	12	4	0	0	
Sub Contractor	9	7	12	0	0	1	
Manufacturer	6	16	16	2	0	0	
Main Contractor	12	8	14	1	0	3	
Specialist Contractor	1	8	14	2	2	11	

Table 2: Centrality measures between nodes

	Degree	Betweenness	Closeness
Client	2	0	14
Sub Contractor	2	0	14
Manufacturer	2	0	14
Main Contractor	4	1.5	12
Specialist Contractor	5	4	11
Supplier	3	0.5	13