
SUPPLY CHAIN CAPITAL IN CONSTRUCTION INDUSTRY: A CONCEPTUAL MODEL

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ABSTRACT

Supply chain management is one of the concepts adopted from other industries and being translated to suit the construction industry in order to bring improvements within the industry. The recent emphasis is on the integration of the whole supply chain because of the fragmented nature of the industry, and the large number of participants involved in a project development process. One of the aspects to achieve integration is by managing both tacit and explicit knowledge existed within a project supply chain through IT systems and social interaction. The main purpose of this paper is to develop a conceptual model, that provides a link between construction organisations and their learning activities as part of a supply chain of a project, resulting in creation of a learning organisation and a learning supply chain. The model shows that the learning supply chains, consist of learning organisations which would create supply chain capital in order to promote innovation and creativity by managing knowledge in supply chains on long term basis. In addition, the learning organisations would also establish a virtual knowledge transfer among themselves and the supply chains they are involved. The paper also suggests that, as unit of competition changes from organisation verses organisation to chain verses chain under supply chain management, supply chain capital will become increasingly important for sustaining competition within construction industry. Therefore, supply chain capitals are to be created through managing knowledge in supply chains on long term basis using the proposed conceptual model. The model also facilitates innovation and creativity essentially required to thrive in the downturn business environment of today in many countries in different parts of the world.

Keywords: Supply Chain Capital, Supply Chain Integration, Knowledge Management, Construction Industry.

1. INTRODUCTION

This changing face of the industry is giving an impetus to the proliferation of business philosophies such as organisational learning (OL) and knowledge management (KM) and supply chain management (SCM) which have their principles solely founded on the notion of trust, commitment and collaboration. Dodgson (1993, p. 377) describes learning organisations as purposefully constructing structures and strategies to enhance and maximise the way that they learn from their experiences and the experiences of others outside their organisations. He claims that they continually transform themselves through facilitating a climate where members are encouraged to learn and share knowledge, linking learning opportunities across the supply chain as well as with clients/customers, and creating development strategies for people and the business centred upon learning. This involves more than KM or SCM. The premise is that as SCM reinforces the concept of whole supply chains

working collaboratively to obtain business benefits, KM principles adopted for the whole supply chain can unleash immense creativity and innovation providing significant competitive advantage to supply chain partners. The main purpose of this paper is to develop a conceptual model, that provides a link between construction organisations and their learning activities as part of a supply chain of a project, resulting in creation of a learning organisation and a learning supply chain. This would result in the formation and building of what we would like to term as “supply chain capital”. A capital which trading partner can look to and rely upon in order to improve their combined performance and productivity and ensuring the project success at the same time. The model shows that the learning supply chains, consist of learning organisations which would create supply chain capital in order to promote innovation and creativity by managing knowledge in supply chains on long term basis. In addition, the learning organisations would also establish a virtual knowledge transfer among themselves and the supply chains they are involved.

2. SUPPLY CHAIN MANAGEMENT (SCM)

SCM is an evolved form of purchasing and logistics-related activities (Croom et al., 2000; Tan, 2001). For over a decade and half, the SCM literature shows a confusion of terminologies and definitions (New, 1997). Some of these include; integrated purchasing strategy, supplier integration, supply base management, buyer-supplier partnership, supplier alliances, supply chain synchronisation, network supply chain, value added chain, logistic integration, lean chain approach, supply network, value stream, etc. (Dyer et al. 1998; Nassimbeni, 1998; Ellinger, 2000) (Tan et al., 1998). While each term addresses elements of a phenomenon, typically focussing on immediate suppliers of an organisation, SCM is the most widely used (but often abused) term describing this process (Tan, 2001). The most realistic and comprehensive definition is provided by the Global Supply Chain Forum (GSCF), a group of non-competing firms and a team of academic researchers dedicated to improve the theory and practice of SCM. According to this group SCM is the integration of key business processes from end user through original suppliers that provides products, services, and information that add value for customers and other stakeholders (Lambert and Cooper, 2000). This sort of integration reduces the product delivery time, reduces waste, minimizes errors and saves on transactional costs thus increasing productivity.

Maqsood et al. (2002) conceptualise the framework to develop supply chain management model by identifying the following five components:

- a) Outsourcing: Identification of supply chains or network structure (trading partners selection) and recognition of key or all trading partners.
- b) Supply Management: Identification of key or all business processes (both purchasing and logistics related) that are to be integrated with trading partners’ business processes.
- c) Chain Management: Identifying a mechanism to transfer the effect of supply management activities, taking place between any two immediate trading partners, up stream or downstream and seamlessly integrate all the trading partners to achieve synchronization.
- d) Relationship Management: Identification of nature of relationships among trading partners for driving supply chain management.
- e) Power Management: Identification of trading partner holding a vantage point.

Supply management and chain management form the basis for supply chain management and may be termed as ‘essential components’ Outsourcing, relationship management and power management are needed to facilitate implementation of supply chain management and may be termed as ‘driving components’. Figure 1 graphically illustrates the components of supply chain management. The outsourcing process is responsible for the formation of supply chains. In a supply chain, immediate trading partners (buyer-supplier) may select one of three interaction levels (CP: Co-operation, CR: Co-ordination and CL: Collaboration) to work together in harmonious atmosphere to execute the supply management activities (comprising of purchasing and logistics related activities).The effect of supply management activities between any two immediate trading partners is transferred upstream and downstream by chain management aspect of supply chain management to achieve synchronization. (For example any delay in a certain purchasing activity between ‘B and C’ should immediately be

reflected into supply management activities between 'B and A' and 'C and D'). The party holding a vantage point in the supply chain should execute the chain management aspect of the supply chain management so that positive integration of business processes in a supply chain may take place and objectives of waste elimination, improved productivity and end user satisfaction are met.

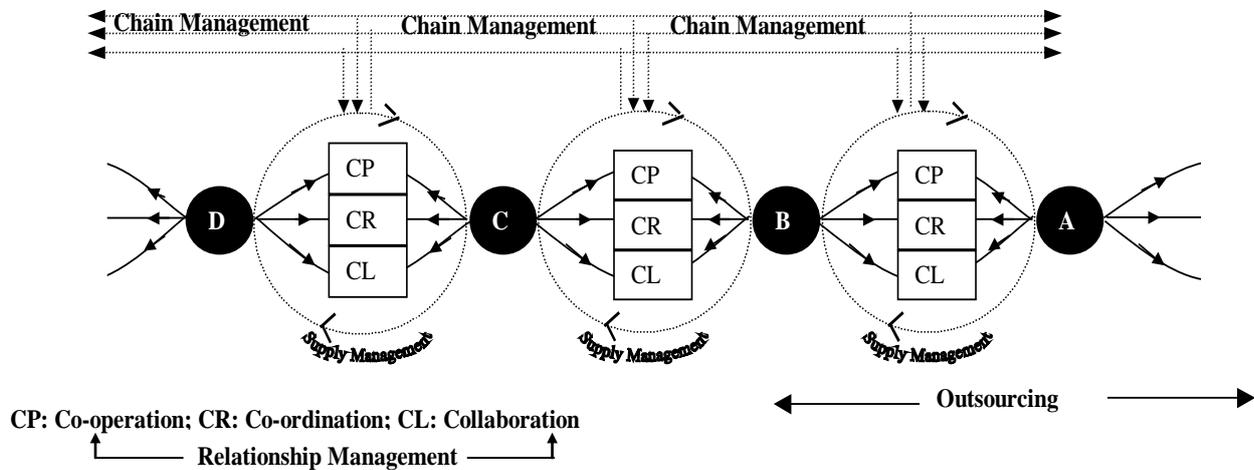


Figure 1: Conceptualization of Generic Integrated Supply Chain Management Model.

3. KNOWLEDGE MANAGEMENT AND SUPPLY CHAIN MANAGEMENT

Both Knowledge Management (KM) and Supply Chain Management (SCM) have taken more than a decade to facilitate mature disciplines where they can be exploited for enhancing business profitability and value. KM is primarily concerned with the capture, codifying, transfer and sharing both tacit and explicit knowledge. Tacit knowledge is embedded in organisational routines and processes and employees heads. It is a very complex type of knowledge. The challenge of knowledge management is to make it explicit through the balanced use of technology, and soft human-related factors like leadership, vision, strategy, reward systems and culture. Explicit knowledge is the type of knowledge that is readily available in the organisation in the form of books, procedures and can be appropriately archived for use when required. An effective knowledge strategy is required to manage both tacit and explicit knowledge in the organisation. KM is about the processes by which knowledge is created, captured, stored, shared, transferred, implemented, exploited and measured to meet the needs of an organisation (Egbu et al., 2001; Maqsood et al. 2007).

In a construction industry, various organisations put together their specialities and knowledge to complete a construction project and turn raw materials into a finished product. Each organisation contributes its knowledge in a form of people, processes and technologies, depending on its position in a supply chain, to the construction process. Traditionally, the selection of these organisations or trading partners is decided based upon spot rate basis. This makes transactional exchange as a dominant form of business in the construction industry (Dubois and Gadde, 2000; Thompson et al., 1998; Gann, 1996). Suppliers' competition in each transaction is assumed to be the most appropriate means of securing efficiency in operations. Due to this reason, actor constellations change all the time, making it difficult to utilize the experience gained in previous projects (Dubois and Gadde, 2000). Cox and Thompson (1997) add that this creates inefficiencies for the client as the supplier climbs a new learning curve each time. Supply chain management deals with these problems by professing upon the philosophy of relational contracting, long term commitment and working together in an atmosphere of high trust and commitment. In such an environment, knowledge is seamlessly created and shared.

The emphasis on knowledge management in such an environment would make possible better sharing of best practice documents, lessons learned across the trading partners and reduce the risk of re-inventing the wheel. Through systematic knowledge management, trading partners would be able to

minimize wasteful activities thus improving productivity and efficiency of whole of the construction process. Knowledge Management under the supply chain management would make it sure that knowledge not information alone, is passed on to the trading partners in a supply chain. Whereas the information simply ascribes to what is required of the trading partner, knowledge management would make sure how to best deliver that product or by ensuring the swift availability of the related knowledge. Simplest supply chain model is modified as shown in Figure 2 to give allowance for flow of knowledge not information alone, from one end of the chain to the other.

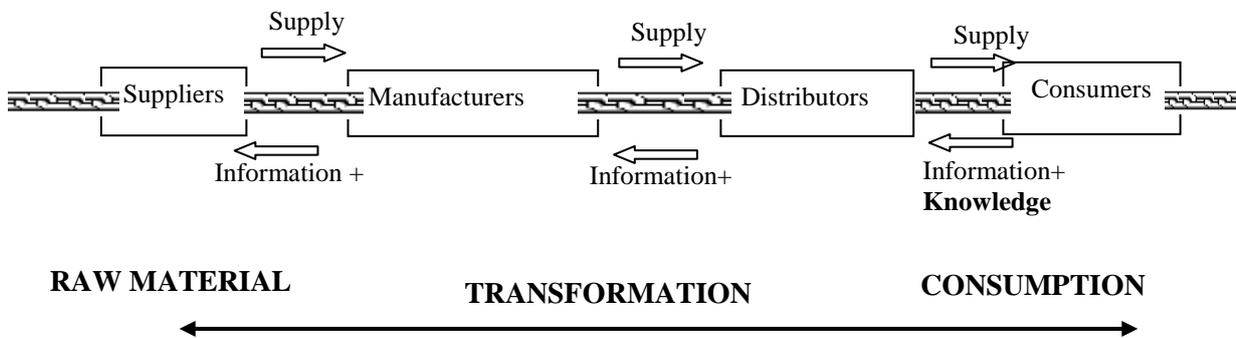


Figure 2: A Simplest Supply Chain Model Modified for Allowing Knowledge Exchange

4. THE LEARNING CHAIN

In the construction industry, organisations come together with their specialities and knowledge to complete a construction project. Each organisation contributes its knowledge in a form of people, processes and technologies, to the construction process. Traditionally, the selection of these organisations or trading partners is based upon a spot rate basis. This makes transactional exchange the dominant form of business in the construction industry (Dubois and Gadde, 2000). The suppliers' competition in each transaction is assumed to be the most appropriate means of securing efficiency of operations. Therefore, actor constellations change all the time, making it difficult to utilise the experience gained in previous projects (Dubois and Gadde, 2000). Cox and Thompson (1997) observe that this creates inefficiencies as the supplier climbs a new learning curve for each project. SCM deals with these problems by promoting relational contracting, long-term commitment and an atmosphere of high trust and commitment (Khalfan et al. 2007).

Collaborative relationships are important for the seamless working of the supply chain management principles. Supply chain management is built on the foundation of trust and commitment (Lee and Billington, 1992). An atmosphere of high trust and commitment is also precursor to employing knowledge management especially in knowledge sharing. Supply chain management provides the essential ground for knowledge management to work by creating such collaborative relationships among trading partners. Spekman et al., (1998) suggested four types of interactions between trading partners; Open market negotiation, Co-operation, Coordination and Collaboration. For facilitating supply chain management, Co-operation (CP), Coordination (CR) and Collaboration (CL) are important interactions that encompass different levels of trust and commitment and involve different roles and responsibilities an organization has to carry out. It is shown in Figure 3.

According to Spekman et al., (1998) 'cooperation' is the threshold level of interaction where firms exchanges bits of essential information and engage some suppliers/customers in longer-term contracts. The next level of intensity is 'coordination' where by both specified work flow and information are exchanged in a manner that permits JIT systems, EDI, and other mechanisms that attempt to make seamless many of the traditional linkages between and among trading parties. The next stage is 'collaboration' where by partners engage in joint planning and processes beyond levels that reaches in

less intense trading relationships. Collaboration requires high levels of trust and commitment, and information sharing among supply chain partners and partners share common vision of the future. An organization may decide to work at any of these three levels of trust and commitment with other trading partner to facilitate the supply chain management and may modify its selection after monitoring the interaction for a certain time pertaining to the change in the effecting factors.

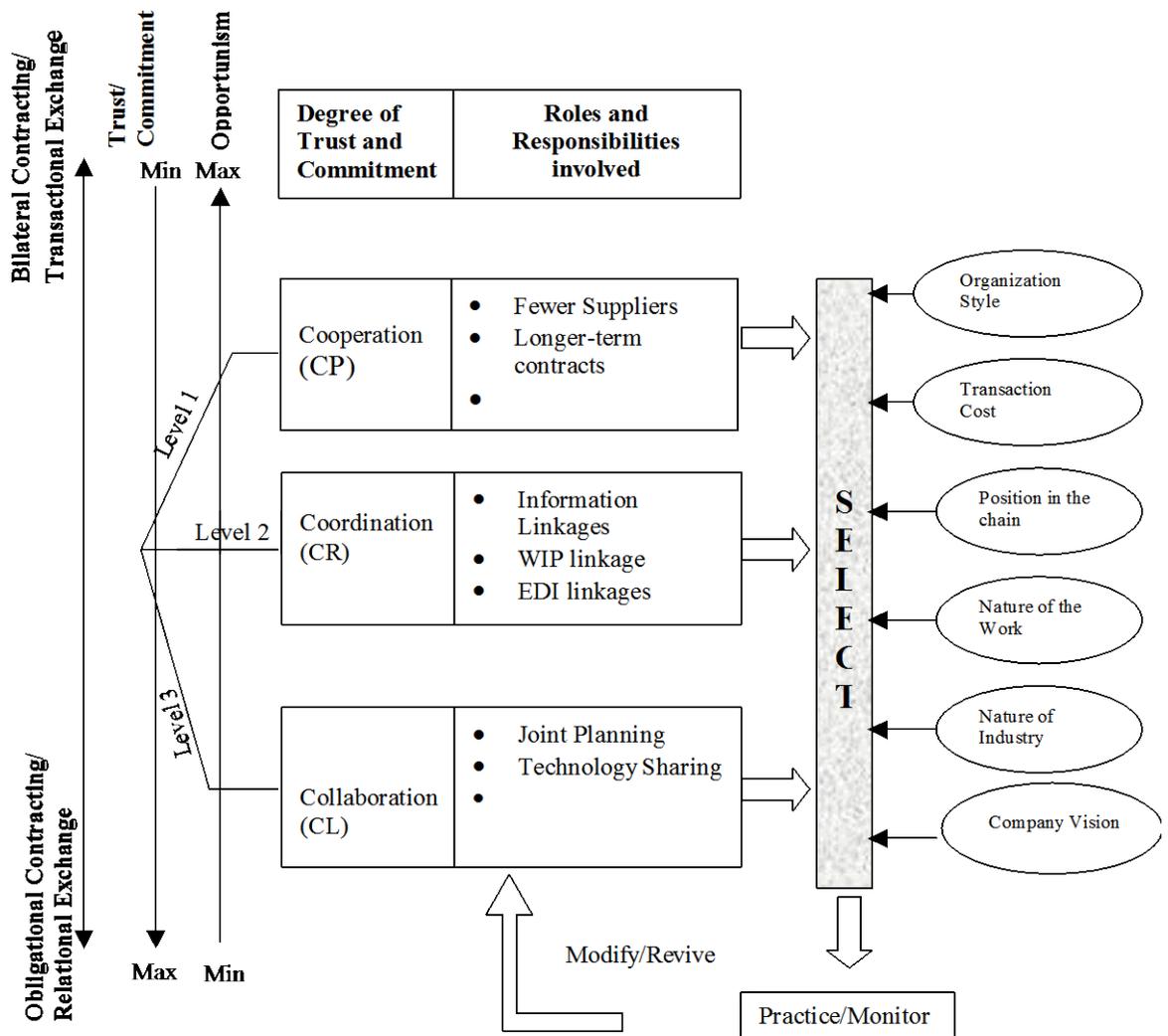


Figure 3: Various collaborative and knowledge sharing modes of Interactions among trading partners (Modified from: Spekman et al., 1998)

It can be easily observed that these various modes of interactions are in fact, limiting the magnitude of knowledge that can be shared with a certain trading partner. Knowledge management in this context would be helpful to provide detailed guidelines as to what sort of knowledge is appropriate to share in a certain mode of interaction. Thus, therein, lies huge potential for knowledge management to serve its perceived role.

5. CREATING SUPPLY CHAIN CAPITAL

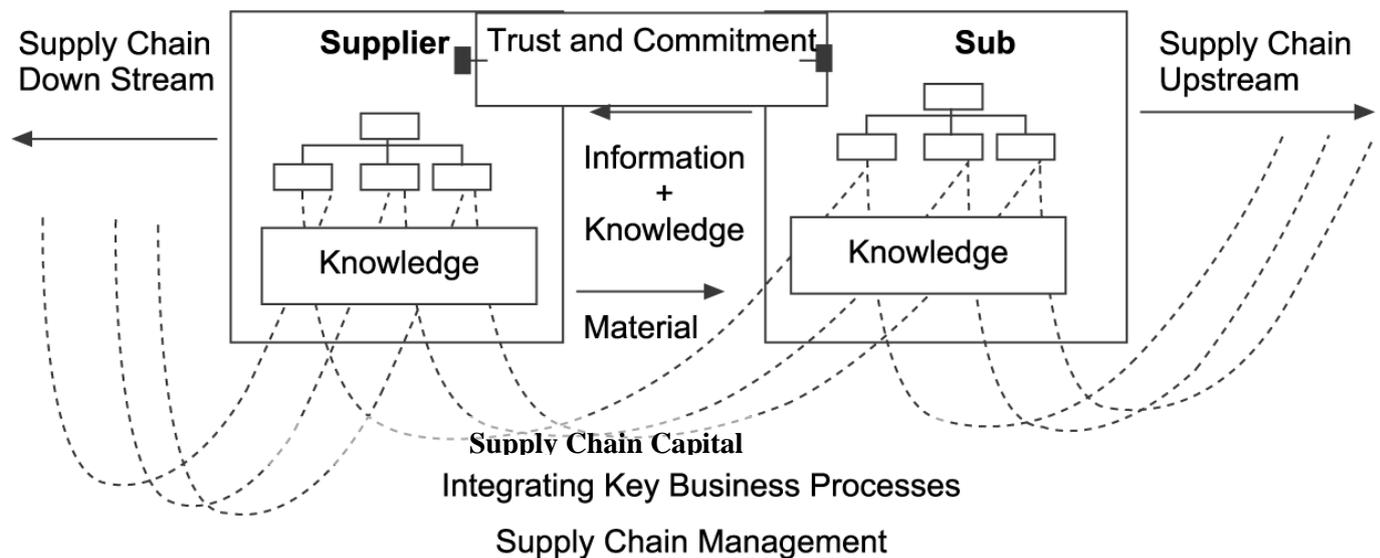


Figure 4: Trading partners adopting SCM and KM and forming Supply Chain Capital (Khalfan and Maqsood, 2010)

As discussed above, bringing trading partners together on a long term basis in a relational contracting would result into an integrated supply chain which is learning from their previous jobs and cutting wasteful activities on their current jobs based on their past experiences. Since these organisations are working together with each other, their level of trust and commitment to each other grow stronger. They are continuously learning how to deliver the best value to their clients and on the other hand they better understand the culture and working practices of all their trading partners. The above discussion on a learning curve now start making sense because if they were to start all over again with new trading partners, it would take them another few years to reach their current level in understanding their trading partners, their way of working and expectation. Therefore, a contractor, who sticks to the same trading subcontractors on many projects, is not only building a better relationship with his trading partners into an integrated supply chain but also creating a supply chain capital; a capital which has resulted from many years of collaboration and many years of knowledge & experience in a specific sector. This brings a competitive edge to the contractor and his integrated supply chain for future work because it would be an added advantage for a client to hire the contractor bringing integrated supply chain because they would not need time to settle down in terms of building understanding and relationship with each other and secondly, they have been doing similar projects for many years and already eliminated wasteful activities from their processes. We authors believe that the clients within the construction industry are now moving towards hiring well performing integrated supply chains which can save them higher construction costs and deliver projects on time and with required specification. In addition to this, clients are also looking for best value which comes through the knowledge capital, human capital of such integrated and learning supply chain thus resulting into supply chain capital – the added value which distinguishes them from all other service providers.

There are many examples especially from the UK construction industry. In general, the main contractor is the one who manages the relationship with trading partners in traditional contracting system. Moving away from traditional and adopting relational contracting scenarios, we would see Design and Build as one of those arrangements where client is establishing the requirement of having an integrated first tier supply chain with a single point of contact and responsibility. In last few years, we have seen many examples of Framework Agreements in the UK, where clients are making it

mandatory for service providers to bid as an integrated supply chain for a programme which consist of many projects over a few years, thus creating the foundation of an integrated and learning supply chain. We have also seen in the case of NHS Procure 21 programme, the integrated supply chains which got the projects in the first cycle to deliver hospital projects, kept on getting projects one after another. The sole reason was that these supply chains were not only integrated but they were learning as well. Over a period of time, these supply chains had developed human capital, resource capital, knowledge capital in building/extending/refurbishing hospitals – hence created supply chain capital which served as added competitive edge for them to win more work and was seen by NHS as achieving best value through their experience and expertise (Khalfan and McDermott, 2006; Khalfan and Tayyab, 2010).

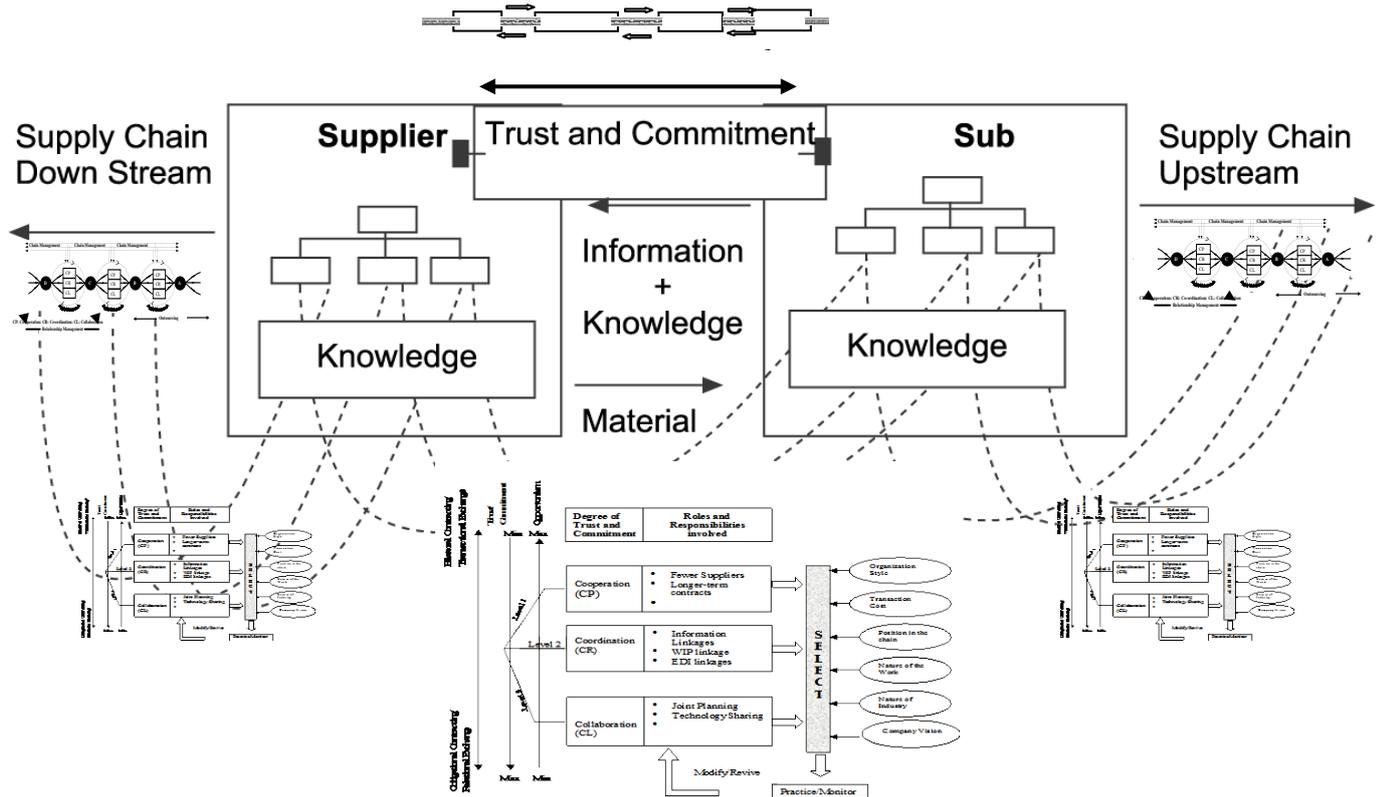


Figure 5: Supply Chain Capital: A Conceptual Model

Figure 5 shows trading partners adopting SCM and KM and forming Supply Chain Capital through various collaborative and knowledge sharing modes of Interactions among themselves. The model also allows Knowledge Exchange within an Integrated Supply Chain. See Figure 6 for the details.

6. DISCUSSION AND CONCLUSION

The development of supply chain capital is in itself an answer to the challenges of the growing complexities and dynamics of the construction world. For an organisation to maintain its competitive edge and continually innovate it has to not only focus on transforming itself into a learning organisation but also to facilitate learning throughout the whole supply chain (of which it is part) to become a learning chain. And over a period of time this learning chain would result into supply chain capital which brings competitive advantages to the trading partners involved in the supply chain.

SCM and KM emerging business philosophies, which place a great emphasis on trust and commitment, are becoming a pre-requisite to achieve this aim. SCM would ensure that key business processes of the trading partners in a supply chain are seamlessly integrated and an environment of

trust and long term commitment is generated and fostered within the supply chain. This will create the appropriate environment to implement and harness KM principles. As a result, it can be ensured that best available knowledge is utilized by each trading partner depending on its position in a supply chain and contribute its best towards a better and improved project outcome by creating and utilising supply chain capital over a period of time, resulting into efficient and effective way of project delivery.

This paper discusses the resulting synergy when two distinct philosophies, supply chain management and knowledge management, perceived to revolutionise the business world are enmeshed together based on their similarities. It is made clear by discovering the potentials of knowledge management when implemented in an environment of supply chain management. The collaborative relationships are important for the smooth working of the supply chain management principles and give rise to an atmosphere of high trust and commitment. Such an atmosphere is also precursor to the implementation of knowledge management principles. Through systematic knowledge management it can be ensured that knowledge not information alone flows through the supply chain under supply chain management.

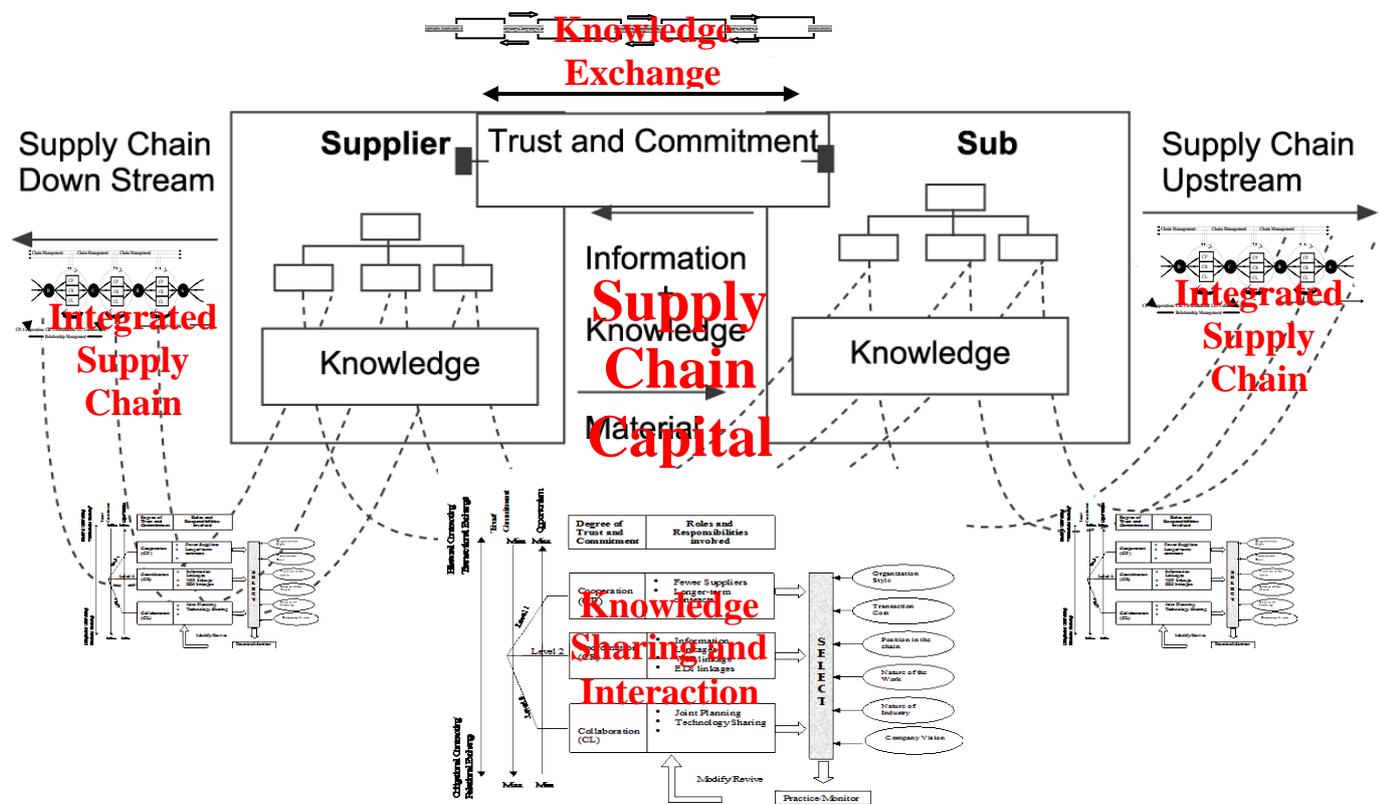


Figure 6: Supply Chain Capital: A Conceptual Model with details

In an environment of supply chain management, an organisation may decide to work with its trading partners at either of three collaborative levels of co-operation, co-ordination and collaboration. These three levels differ in the magnitude of information and knowledge that is shared with the trading partners. Knowledge management may play an important part in providing the mechanism and detailed guidelines so as to classify the required information and knowledge for these collaborative modes of interaction. Furthermore, it would make sure that knowledge management is implemented throughout the supply chain and not only restricted to the big organisations that hold the vantage point in the chain. This would ensure that industry as a whole benefits from its principles.

7. PROPOSED FURTHER RESEARCH

The concept of Supply Chain Capital needs sound validation through case studies from the construction industry. In order to present the concept to the industry for implementation, authors have further research plans to develop tools and techniques which would help the industry grasp adequate understanding of the concept and its measurement. A conceptual model developed will be modified with industrial collaboration for establishing supply chain capital along with suggested ways to measure its value, effectiveness, and performance. With the help of pilot study, the model will be validated for the measurement.

The major contribution of the authors will be to show how the concept could be used in an existing procurement process to fill in identified gaps in such a way that current practitioners treat the concept as value adding to their organisation and processes. A speculation on how this could improve procurement will also be made by the authors. An MSc or MPhil student can take the above topic as his/her Masters thesis or a PhD student can specialise in the above mentioned concept under the direct supervision of the authors. Case study research methodology would be adopted for a PhD level research work along with the Action research method, where student would be part of the decision making process while utilising the proposed model.

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