

Collaborative Supply Chain Management (SCM) Tools for Improved Teamwork in Construction Projects

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Abstract— Fragmentation or the separated working environment has been a major hinderance to effective collaboration among construction industry players and these has been mainly blamed upon the wasteful conventional working practice. Supply Chain Management (SCM), which hold tightly on the notion of collaboration being among its most important enabler and has also proven to contribute to many important elements of an effective collaboration such as better trust, transparency, knowledge sharing, pain-gain sharing etc.; has therefore been promoted to overcome the problem via numerous Collaborative Tools it has to offer. This paper presents part of an on-going research aimed at using SCM Tools to overcome delay and definitely collaboration is an aspect that needs improvement. After conducting a comprehensive literature reviews on past proposal and applications, a number of SCM Collaborative Tools have been identified, elaborated and discussed in this paper; which is expected to serve as a guide towards adopting SCM into construction project practices and thus, achieve the benefits it has to offer. Some of them have been applied in major projects and experienced success hence, deserve more appreciation by the construction world

Keywords— Collaboration, Construction Industry, Project Team, Supply Chain Management (SCM), Fragmentation.

1. Introduction

A major problem facing the construction industry worldwide is the separated nature of working environment; also known as fragmentation [1], [2]. It has been linked with numerous performance-related issues facing the industry [3] such as delays, cost overrun, low satisfaction level and many more; as well as problems related to coordination and integration of the supply chains [4]. The interface among project entities has been regarded as utmost vital aspect of construction projects [10], which does not come as a surprise considering the

numerous parties involved both from inbound and outbound levels which are expected to work with each other to deliver the client's wants. Not only does poor collaboration lead to lacking in performance but; it also impedes innovative idea and solutions since the abundance of knowledge, information and experience within the project team cannot be properly utilized [4]. The fact that collaboration has very close connection with the ability to be innovative [5] suggests the need for the industry to raise up this aspect of practice; which can be enabled via SCM [4]. In the past, the literature has been flooded with numerous SCM tools aimed at tackling diverse inefficiencies (i.e. poor collaboration) faced by the industry; while others have also applied these tools with success (see [6-8]). The industry has also been convinced of the need to shift practices [9], [10] and the vast potential of modern approaches (i.e. SCM) have been well proven (e.g. [8],[11],[12]). In fact, SCM has been endorsed and recommended as the way forward by many (e.g. [13], [14]).

2. Potential of Supply Chain Management (SCM) to Improve Collaboration among Project Participants

Past findings have established time, cost and quality as the main target of every project [15] and organizations have started to recognize the close connection between team dynamics and the ability of firms to be continuously competitive [4] which strongly connects to the need to improve collaboration among project parties to function as a lively team. In fact, collaboration has been strongly connected to SCM [4] and that problems in this area can lead to delays and cost overrun [8]. In general terms, collaboration refers to the process that involves a minimum of two (2) parties working

together towards a same direction via effective utilization of resources available between them. Beyond that, integration, communication and coordination also are activities that make part of the collaboration process [4] and has been regarded by [1] as being the “*leitmotiv*” of published reports in regard to the importance for industry practices to make a shift. Improved collaboration has been connected to the betterment of understanding, reaction to client variations, sharing of information [16], knowledge transmission [17], and focus on mutual goals [18]; but to make it effective, it is vital that the parties trust each other [19], so that they can create an inclination towards aligning with each other [20].

SCM has continuously prove its ability to contribute and enhance the industry’s ineffective practices. The way in which SCM functions to improve relationship between parties and thus collaboration, lies beneath a number of its quality traits. It holds onto the notion that honesty is vital because it leads to better transparency [21], reduces the need for lengthy paper-works [22], improves coordination [23], promotes pleasant behaviours [24] which consequently leads to higher level of trust and commitment [21], all of which are important elements of good collaboration. As a result of SCM practice, performances could be improved in the sense that the project team would; be more encouraged to share information and knowledge due to the trust they possess on one another [25] thus, information flow will improve [23], better responsiveness can be experienced [26], [27] and hence, enables better decision making [27], reduced dispute and conflicts [24] and of course enhanced performances, competitiveness [28] and customer satisfaction [26].

3. SCM Collaborative Tools Proposed and Adopted in The Past

Past studies have proved that SCM has indeed been continuously proposed as the way forward and they were manifested via channels such as research proposals, government reports, public sector agenda and so on. However, to make SCM effective, it is vital that all parties across the chain are brought together to play their respective roles and these include not only the client, contractor and consultants but also other inbound and outbound organizations such as the authorities, suppliers,

manufacturers, financial providers and many more depending on project circumstances. Effective collaboration among all these entities are would lead to a healthy teamwork environment which would definitely benefit projects and the team as a whole.

Nevertheless, proper SCM implementation require adoption of wide-ranging tools [4] towards integrating parties and making full use of valuable traits and assets possessed by all of them; ultimately aimed at delivering best value for the customer. These therefore leads to the next important question which is “how it shall be done?”. The importance of adopting appropriate tools for effective SCM implementation could be tracked back to the statement made by [29] who looked into the Hewlett-Packard supply chain practices whereby he proclaimed that “*without an adequate analysis tool, opportunities for change might be lost for want of a credible argument*” (p. 37). Also, it is important to ensure that appropriate tools that targets specifically on the areas that needs improvement (i.e. collaboration) so as to ensure that the desired outcomes can be attained. Only then other inter-connected benefits would surface and be enjoyed by everyone such as improved innovation through generation of groundbreaking ideas, reduced conflicts, minimized errors and reworks and many more.

Researchers and practitioners worldwide have long realized the importance of collaboration as the key for a successful project. In fact, all facets of project typically stem from a good collaboration and thus, this has led to proposal and application of many SCM tools aimed at addressing the issue. The following represents a number of SCM tools proposed and/or adopted in the past and how they contribute to improved collaboration in a project setting:

3.1. Champion / Driving Personalities

Driving figure as among collaborative tools has in the past been highlighted by many researchers [30] and was regarded by [1] as an enabler for achieving common goal among all project member. The success of construction SCM highly depend on good leadership style as one of the people factor [31] because leaders are responsible for making available the best possible working environment that is conducive for all parties to perform [32].

Therefore, it is important that they have admirable dispositions so as to ensure that best possible outcomes are delivered [33]. Champion / Driving Personalities ensures that proper collaborative effort is practice throughout projects; by making sure that all SCM initiatives are undertaken by everyone according to what have been planned towards fulfilling the mutually agreed goals of a project endeavour [4]. The ability of this tool to affect the participants mind-set, work practice, generate innovative ideas [18] as well as encourage transparent communication, better cooperation and also to inspire brainstorming to overcome problems [34]. With these regards therefore, there is no doubt that an effective leadership should be accepted as a strategic goal of an organisation [35] in which they can highly benefit from the use of a good Champion / Driving personalities and shift away from the “*boss-like*” leaders in conventional undertakings.

3.2. Joint Agreed Goals

A good collaboration would not be possible if project parties have conflicting goals while executing a project because it would lead them to focus more on their individual goals rather than the project objectives. In order for everyone to work as a team, having the same direction is vital so as to ensure that all efforts are channelled towards achieving them as a squad. In the context of SCM, jointly agreeing on a set of goals is highly encouraged [36] and this tool has been regarded as a good collaborative tool by many researchers [30]; since it certainly has an effect on the team’s behaviour [2]. Collaboration, being a crucial feature of SCM [26] and triumphant relationships [18] enables improvement of project performances via its ability to ensure achievement the best of communication, integration and coordination [37]. Application of this tool in projects also develops a habit of collectively prioritizing, strategizing and focusing on tasks and therefore, keep committed to the project [4]. A research by [38] also recognised teamwork as being the utmost vital feature of an effective “people based management” while [39] regarded jointly agreed goals as being important to influence human’s behaviour thus achieve good cooperation; an important element of effective collaboration.

3.3. Building Information Modelling (BIM)

Information Technology has long been promoted as means of gaining operational, tactical and strategic edge (Love et al., 2004) [1]. “Building Information Modelling” (BIM) is a form of technological tool for an “integrated building design” whereby it combines a variety of important project dimensions to facilitate improved level of coordination and collaboration in projects [40]. BIM, which is commonly in form of smart software, provides a platform for the variety of parties involved in projects to collaborate and communicate project information such as design details, costings, variations and so on thus creating a well-coordinated project team environment whereby effective sharing of information, resource, data, etc. can take place. It makes the task of decision making an efficient one via the utilization of knowledge and resource sharing concepts [41] thus ensuring the consistent preparation of drawing and specifications [4] and consequently reduce unforeseen changes by 40% [42]. The great benefit of this tools has led it to grow in popularity [43] which signifies the effectiveness of this tool in making effective collaboration an easier task to accomplish especially since projects has increased in complexity and requires greater level of coordination to ensure they can be executed in the best possible manner.

3.4. Pre-Qualification using “Team Criteria” Scores

The success of a project has a lot to do with having the right group of people to work as a team [18] because collaboration cannot be forced upon and should be cultivated via good understanding and chemistry among the people involved. The need for a systemic view is an important concept promoted via SCM [44] thus, to make this happen, it is important that multiple aspects are considered in selecting parties to form a project team. Proper approach to evaluating project members is important due to the effect it poses on the success of enterprises [44] thus, there have been initiatives to impose additional criteria other than the price aspect for contractor selections [6] and the same has been used for choosing other project parties [9]. SCM emphasizes on synchronizing the entire team rather working fragmentedly hence stresses on the need to ensure project teams are made of the best individual / groups so as to achieve high efficiency

[4]. The Pre-Qualification using “*Team Criteria*” Scores was a tool initially introduced by [18] whereby it utilizes a “suitable multi-attribute decision-making model” which considers aspects such as technical, relational and sustainability towards developing an effective project team. The way in which the tool function is by weighing each aspect depending on which best suit the client’s expectations and ensuring that a balanced team with best chemistry among them are selected therefore certifying that good collaboration, coordination, communication and integration can naturally take place between them. This tool has in the past been implemented by the British Airport Authorities whereby they managed to save 15 months of project time as a result of it [8].

3.5. Early Involvement of all Supply Chain

Early involvement of supply chains serves as a tool that proposes bringing in other project parties such as the contractor, supplier, manufacturer etc. at an earlier stage to ensure that interactions between them takes place as early as possible. When members start their involvement with each other right from the pre-construction phase, they can start developing understanding between them during their communication and coordination of project detail preparation. This tool has in the past been adopted by few UK clients as a form of their SCM initiative [9] and had also proved time-efficient in another study (see [6] since it promotes better utilization of resources and information available within the supply chain. In practice, suppliers make a big part of project participants thus; performance of the whole project entities closely connects to the proper management of the project suppliers [45] and that bringing in early the contractors and sub-contractors have also proved time and cost effective [6] since they also form a significant part of projects other than suppliers. Being the “implementer groups” [4], their early involvement can highly benefit the project not only in term of making better project decisions but also to establish understanding for an effective collaboration and teamwork with other project parties as early as possible before the actual physical works commences at site, whereby any problems at that stage directly translates to losses, be it in form of fiscal, time, quality and others.

3.6. Joint Risk Management (JRM)

Risk Management (RM) involves processes of predicting possibilities of risks, scrutinizing them to consequently come out with verdicts [46] which best serves the interest of projects and its stakeholders. However, for effective risk administration, there are needs for collaborative initiatives [4] such as Joint Risk Management (JRM). JRM represents an improved practice of the previous Risk Management practices by taking a collaborative approach thereby making it more effective, efficient and able to better satisfy all parties in a project. Similar to other initiatives in construction, risks should also be addressed collaboratively because a project consist of many dimensions and therefore risks can also surface as result of many inter-connected aspects. Only through teamwork that sharing of information and joint problem solving is possible [47] and that triumphant relationships have been regarded by [48] as the “*enabler of risk mitigation*” hence; affecting project performances that have long been perceived to closely connect with risks [49]. Uptake of JRM also encourages project parties to work together towards identifying, analysing and deciding on how to go about with project risks and make decisions based on the approval of everyone which is important to avoid future conflict and dissatisfaction. While JRM can be considered to be relatively new initiative with practitioners generally still go for the common RM approaches, but there have been past applications that were proven successful. One such case was its success implementation on the UK’s M41 programme [6] as well as three (3) months’ time saving in the T5 project also in UK [50].

3.7. Regular Joint Review

The ability of collaborative efforts to promote better productivity and efficiency in projects has been evident and that its benefit has led to proposal of many team-oriented practices. One of them being the “*Regular Joint Review*”, brought forwards by [46] as a different form of Risk Management response in projects. It benefits from the brainstorming of ideas, experience, information and knowledge throughout the whole supply chain towards consequently captivating the best way forward in projects [4]. Construction project, even of similar types, may have disparities with each other in aspects such as locality, local policies, site

conditions, etc. thus, by regularly reviewing every aspect of projects would enable their early detection for necessary actions to be strategized in place. By benefiting from pooling of ideas, experiences and knowledges ensures that thorough and diverse considerations are made for each and every project decisions that are made.

3.8. Profit Sharing Arrangement

A major weakness in the acquaintances of the construction industry lies beneath the win-lose nature of practices and the absence of pain-gain sharing practices. [9]. It has been a norm that all profits generated generally goes to the client even if the contractor or other parties contributed to the extra savings that was made. This in turn, has been a demotivator for parties to be innovative and perform beyond what have been agreed since no extra fiscal gains are achievable should more savings are created. Profit sharing, a practice known to have been used on other industries; motivates people and influences their behaviour to stick firmly to their pre-set agenda [4] however, it lacks application in construction probably due to the nature of contracts that fixes all fiscal aspects of projects. "Profit sharing basically offers extra monetary gains as a result of savings in projects (i.e. reduced cost), certain target being achieved (i.e. early completion), etc." [4] and its ability to foster improved collaboration [54], long-term performance as well as continuous improvements has been evident, which are crucial facets for delivering successful projects. In fact, when a project client commits to sharing their extra gains with others would motivate them to work together to achieve maximal savings in attempt to maximize their profit. Willingness to share positive outcomes of projects also indicate commitment to team's agenda of working together to deliver the project appropriately.

3.9. Risk Sharing Arrangement

Opposing the Profit Sharing initiative is the Risk Sharing; described by [51] as "1) the party who can assess and control the risk should bear it; 2) if none of the parties can assess or control the risk, the party who can bear it easier or procure the insurance from the market should bear it". It has been linked to better team performance [52] and obligations to shared goals [53] and uses "scare" as the driver for performance [4]. "Scare" or "fear"

from this context is also a push factor in many instances for example a fear of losing job could be the driver or motivator for workers to perform at their best and deliver the bosses targets. Similarly, in the context of a construction project environment, the fear of one party being the reason for others' losses would be a push factor for them to give their best commitment to the team and focus on delivering the project objectives [4]. Other than that, especially for the client side, Risk Sharing arrangement definitely justifies their commitment to collaborate and work as a team since they are willing to place their profit margins on the line should the project suffer extra losses and, it also encourage them to commit to the team agenda of delivering the project in best possible manner thus discouraging them to do things that further complicates situations such as imposing late changes which would lead to variations and thereby extra cost (or reduced profit) in the project. As for the other project parties, having to share project losses also encourages better teamwork for instance the integration between the designers and quantity surveyors during the pre-construction stage to avoid repetitive works such as re-designing due to inappropriate designs and missing details. These situations definitely picture an improved collaboration, which is benefited from the act of sharing project risks [54] and by fairly distributing responsibilities also inspires better teamwork [55]. Risk sharing encourages human to be creative and search for better ways to perform such as via improving level of collaboration and teamwork among team members [4].

4. Methodology

This paper is part of an on-going research on the supply chain issue that affect to the construction industry in Malaysia. Multiple approaches have been employed in order to ensure that the data is gathered in comprehensive and accurately. For the early stage of this study, this paper has been written that based on the literature or secondary source of data. A literature review, considered by many as part of research methodology, is essential in organising theoretical framework, developing a pertinent problem statement and research questions, and forming conjectures before formulating hypotheses to be tested. In this regard, previous study [56] has aptly opined that a thorough literature review is a "critical analysis of a segment

of a published body of knowledge through summary, classification, and comparison of prior research studies, reviews of literature, and theoretical articles.” This is precisely what this paper intends to present.

Through the literature review, the definition, and SCM application as collaborative tools for overcoming the issue of fragmentation is examined and highlighted. All the data and information gathered directly from libraries, books, articles and other printed materials searched in the international and national journals, proceeding and bulletin. This literature review is very important and helpful in the process of developing for the theoretical sections of the actual research.

5. Discussion and Conclusion

In overall, there are clear evidences of the potential of SCM to improve level of collaboration between project team members which could be facilitated via wide-range of Collaborative Tools embedded within the practice of its philosophy. Since SCM hold tightly on the notion of collaboration being among its most important enabler, and that it has been proven to contribute to many important elements of an effective collaboration such as improved level of trust, transparency, exchange of knowledge, pain-gain sharing etc. thus, it makes better sense to adopt this philosophy into practice to achieve the best of teamwork among participants which have time and time again been proven to lead towards success be it from financial standpoint and also other aspects that pictures a successful project such as timely completion, improved satisfaction, reduced conflicts and so on. This study has therefore explored this aspect of SCM and introduced a number of SCM Collaborative Tools that have been proposed, practiced and proven successful in the past. They were: - Champion / Driving Personalities; Joint Agreed Goals; Building Information Modelling (BIM); Pre-Qualification using “*Team Criteria*” Scores; Early Involvement of all Supply Chain; Joint Risk Management (JRM); Regular Joint Review; Profit Sharing Arrangement; Risk Sharing Arrangement. While these tools may not be exhaustive but they can well serve as a guide towards adopting SCM into construction project practices and thus, achieve the benefits it has to offer. Some of them have been applied in major projects and experienced success hence, their value need more appreciation by the

construction world. Nevertheless, there is an obvious need of a change in mind-set should these tools be fully integrated into the current practices since it requires a major shift from current working culture which are clearly short of values such as higher transparency, improved trust (especially with the lower-tiers of supply chain), sharing of gain and pain faced in projects, involvement of supply chains (other than the contractor) in earlier project phases and many more; all of which require alteration to the common team practices which are fairly absent in conventional exercises.

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References

- [1] Love, Peter ED, Zahir Irani, and David J. Edwards. “*A seamless supply chain management model for construction.*” Supply chain management: an international journal Vol 9, No.1, pp. 43-56, 2004.
- [2] Mohamed, Sherif. “*Web-based technology in support of construction supply chain networks.*” Work Study, Vol 52, No.1, pp. 13-19, 2003.
- [3] Xue, Xiaolong, et al. “*An agent-based framework for supply chain coordination in construction.*” Automation in construction, Vol 14, No. 3, pp. 413-430, 2005.
- [4] Riazi, M., & Riazi, S. “*The use of supply chain management to reduce delays as result of pre-construction deficiencies in Malaysian public sector construction projects*” (Doctoral dissertation, Queensland University of Technology), 2014.
- [5] Soosay, Claudine A., Paul W. Hyland, and Mario Ferrer. “*Supply chain collaboration: capabilities for continuous innovation.*” Supply chain management: An international journal, Vol. 13, No. 2, pp 160-169, 2008.
- [6] Kumaraswamy, Mohan, et al. “*Integrating procurement and operational innovations for construction industry development.*” Engineering, Construction and Architectural

- Management, Vol 11, No. 5, pp. 323-334, 2004.
- [7] National Audit Office. *"Improving Public Services through better-construction"*. London: NAO, 2005.
- [8] Potts, K. *"Construction supply chain management: Concept and case study"*, 2009.
- [9] Palaneeswaran, Ekambaram, Mohan Kumaraswamy, and S. Thomas Ng. *"Formulating a framework for relationally integrated construction supply chains."* Journal of Construction Research, Vol 4, No. 2, pp. 189-205, 2003.
- [10] Vrijhoef, Ruben, and Lauri Koskela. *"The four roles of supply chain management in construction."* European journal of purchasing & supply management, Vol 6, No. 3-4, pp. 169-178, 2000.
- [11] Attaran, Mohsen. *"Nurturing the Supply Chain."* Industrial Management, Vol 46, No. 5, 2004.
- [12] Daugherty, Patricia J., et al. *"Reverse logistics: superior performance through focused resource commitments to information technology."* Transportation Research Part E: Logistics and Transportation Review, Vol 41, No. 2, pp. 77-92, 2005.
- [13] Egan, J. *"Rethinking Construction: The Report of the Construction Task Force, DETR, London."* 1998.
- [14] Strategic Forum. *"Rethinking construction: Accelerating change. Consultation paper. London: Strategic Forum for Construction"*, 2002.
- [15] Chan, Albert PC, and Ada PL Chan. *"Key performance indicators for measuring construction success."* Benchmarking: an international journal, Vol. 11, No. 2, pp. 203-221, 2004.
- [16] Chow, Harry KH, King Lun Choy, and Wing Bun Lee. *"Knowledge management approach in build-to-order supply chains."* Industrial management & data systems, Vol. 107, No. 6, pp. 882-919, 2003.
- [17] Goh, Swee C. *"Managing effective knowledge transfer: an integrative framework and some practice implications."* Journal of knowledge management, Vol. 6, No. 1, pp. 23-30, 2002.
- [18] Kumaraswamy, Mohan M., et al. *"Targeting relationally integrated teams for sustainable PPPs."* Engineering, Construction and Architectural Management, Vol. 14, No. 6, pp. 581-596, 2007.
- [19] Sahay, B. S. *"Supply chain collaboration: the key to value creation."* Work study, Vol. 52, No. 2, pp. 76-83, 2003.
- [20] Rowlinson, S., & Cheung, F. Y. K. *"Alliancing in Australia – A long term JV? In Proceedings Cooperative Research Centre (CRC) for construction innovation's third international conference - Clients driving innovation: Benefiting from innovation"*, Gold Coast, Australia, 2008.
- [21] Ali, Farooq, Gareth Smith, and Jim Saker. *"Developing buyer-supplier relationships in the automobile industry A study of Jaguar and Nippondenso."* European Journal of Purchasing & Supply Management, Vol 3, No. 1, pp. 33-42, 1997.
- [22] Turner, Jerry R. *"Integrated supply chain management: what's wrong with this picture?."* Industrial Engineering, pp. 52-55, 1993.
- [23] Ahmed, Syed Mahmood, Salman Azhar, and Irtishad Ahmad. *"Supply chain management in construction: Scope, benefits and barriers."* Delhi Business Review, Vol 3, No. 1, pp. 1-6, 2002.
- [24] Briscoe, Geoffrey H., et al. *"Client-led strategies for construction supply chain improvement."* Construction Management and Economics, Vol. 22, No. 2, pp. 193-201, 2004.
- [25] Edum-Fotwe, F. T., A. Thorpe, and R. McCaffer. *"Information procurement practices of key actors in construction supply chains."* European journal of purchasing & supply management, Vol. 7, No. 3, pp. 155-164, 2001.
- [26] Horvath, Laura. *"Collaboration: the key to value creation in supply chain management."* Supply chain management: an international journal, Vol 6, No. 5, pp. 205-207, 2001.
- [27] Cheng, Jack CP, et al. *"A service oriented framework for construction supply chain integration."* Automation in construction, Vol. 19, No. 2, pp. 245-260, 2010.
- [28] Burgess, Rachel. *"Avoiding supply chain management failure: lessons from business process re-engineering."* The International Journal of Logistics Management, Vol. 9, No. 1, pp. 15-23, 1998.
- [29] Davis, Tom. *"Effective supply chain management."* Sloan management review, Vol. 34, pp. 35-35, 1993.
- [30] Eriksson, Per Erik. *"Procurement effects on coopetition in client-contractor relationships."* Journal of construction Engineering and Management, Vol. 134, No. 2, pp. 103-111, 2008.
- [31] Mentzer, John T., James H. Foggin, and Susan L. Golicic. *"Collaboration: the enablers, impediments, and benefits."* Supply chain management review, Vol. 4, No. 4, pp. 52-58, 2000.
- [32] Leiter, M., & Maslach, C. *"Beating burnout"*. Human Resource Management International Digest, Vol. 10, No. 1, pp. 6-9, 2002.

- [33] Everett, Carol Lindborg. "Penn State's Commitment to quality improvement." *Quality Progress*, Vol. 35, No. 1, pp. 44, 2002.
- [34] Cheung, Yan Ki Fiona, and Steve Rowlinson. "Relational contracting: the way forward or just a brand name?" 2005.
- [35] Feigenbaum, A. "Total quality control" (3rd ed.). New York, NY: McGraw-Hill, 1991.
- [36] Maqsood, Tayyab, Andrew D. Finegan, and Derek HT Walker. "Extending knowledge management across the supply chains in the construction industry: knowledge sharing in construction supply chains." 2003.
- [37] Sui Pheng, Low, and Teo Hui Fang. "Modern-day lean construction principles: Some questions on their origin and similarities with Sun Tzu's Art of War." *Management Decision* Vol. 43, No. 4, pp. 523-541, 2005.
- [38] Kanji, Gopal K. "Measurement of business excellence." *Total Quality Management*, Vol 9, No. 7, pp. 633-643, 1998.
- [39] Love, Peter ED, et al. "Total quality management and the learning organization: a dialogue for change in construction." *Construction Management & Economics*, Vol. 18, No. 3, pp. 321-331, 2000.
- [40] Holness, G. V. R. "BIM Gaining Momentum." *ASHRAE Journal*, Vol 50, No. 6, pp. 28-40, 2008.
- [41] National Institute of Building Sciences buildingSMART alliance (2012). National BIM Standard (V2). Retrieved December 3rd, 2012, from <http://www.nationalbimstandard.org>
- [42] Azhar, Salman, et al. "Building Information Modeling (BIM): A new paradigm for visual interactive modeling and simulation for construction projects." *Proc., First International Conference on Construction in Developing Countries*. Vol. 1. 2008.
- [43] Young, Norbert W., et al. "The business value of BIM-getting building information modeling to the bottom line." pp. 52, 2009.
- [44] Liu, Zhiqiang, and Chen Liu. "Partner selection of construction supply chain based on rough set and BP neural network." 2010 2nd IEEE International Conference on Information Management and Engineering. IEEE, 2010.
- [45] Sarkar, Ashutosh, and Pratap KJ Mohapatra. "Evaluation of supplier capability and performance: A method for supply base reduction." *Journal of Purchasing and Supply Management*, Vol 12, No. 3 pp. 148-163, 2006.
- [46] Ritchie, Bob, and Clare Brindley. "Supply chain risk management and performance: a guiding framework for future development." *International Journal of Operations & Production Management*, Vol 27, No. 3, pp. 303-322, 2007.
- [47] Cheung, Yan Ki Fiona. "Sustainable relationship: an Australian case study." *Proceedings of the Construction, Building and Real Estate Research Conference of the Royal Institution of Chartered Surveyors (COBRA 2010)* 2010.
- [48] Nishat Faisal, Mohd, Devinder Kumar Banwet, and Ravi Shankar. "Supply chain risk mitigation: modeling the enablers." *Business Process Management Journal*, Vol. 12, No. 4, pp. 535-552, 2006.
- [49] Knight, F. H. "Risk, uncertainty and profit". New York, NY: Houghton Mifflin Company, 1921.
- [50] National Audit Office. "Improving Public Services through better-construction". London: NAO, 2005.
- [51] Onishi, Masamitsu, Toshihiko Omoto, and Kiyoshi Kobayashi. "Risk-sharing rule in project contracts." *IEEE International Conference on Systems, Man and Cybernetics*. Vol. 6. IEEE, 2002.
- [52] Micheal, H., and Champy James. "Reengineering the corporation: a manifesto for business revolution." New York: Harper Collins 10, 1993.
- [53] Eriksson, Per Erik, and Ossi Pesämaa. "Modelling procurement effects on cooperation." *Construction management and economics*, Vol 25, No. 8, pp. 893-901, 2007.
- [54] Phillips, Nelson, Thomas B. Lawrence, and Cynthia Hardy. "Inter-organizational collaboration and the dynamics of institutional fields." *Journal of management studies*, Vol. 37, No. 1, 2000.
- [55] Spekman, Robert E., John W. Kamauff Jr, and Niklas Myhr. "An empirical investigation into supply chain management: a perspective on partnerships." *Supply Chain Management: An International Journal*, Vol. 3, No. 2, pp. 53-67, 1998.
- [56] Wisconsin, 'Literature Review', Writing Studio, Duke University, <http://uwp.aas.duke.edu/wstudi>, viewed: 15/12/2008.