

REORGANIZATION OF SUB-CONTRACTOR MANAGEMENT PRACTICES IN ALLIANCE CONTRACTS

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Project alliancing involves the collaboration of owners and non-owner participants (designer, contractors, and suppliers) to deliver projects, with all participants sharing the responsibility for project risks in achieving project objectives. But in real practice, it fails to create a true alliance environment since only part of the value chain (owner, designer, main contractor) is considered for integration. Consequently, sub-contractors are not within the alliance and alliance members are not interested in improvements in sub-contractors' processes. Therefore this research identifies and recommends changes in the alliance process so that critical sub-contracting processes can be integrated into the main alliance project. To achieve this objective the research follows a comparative study approach. Information obtained from the review of literature is used to identify current sub-contractor management practices and best practices for sub-contractor integration in alliances. Case study of an alliance project was used to identify certain failure factors in sub-contractor management practices in an alliance environment. From these findings, the study proposes a framework to improve sub-contractor management practices in alliance by using lean supply principles. It is concluded that sub-contractor management practices in real alliance lies between traditional supply and lean supply systems and integration of sub-contractor to the alliance will change the win-loss behaviour.

Keywords: Alliance, Sub-contractor management practices, Sub- alliance, Lean supply.

INTRODUCTION

In alliance projects, owners and non-owner participants work as an integrated team to deliver projects under a contractual framework where their commercial interests are aligned with project outcomes (Ross, 2003). Literature on alliance show that most projects focus on owner–designer-main contractor alliances but with few projects extending alliance practices to sub-contractors. The integration of sub-contractor management in alliance has been on a project by project basis, and where sub-contractor management has been integrated into alliances, good project performances were recorded (Miles, 1998).

Kwok and Hampson (1997) showed that strategic alliances between contractors and sub-contractors produce superior client satisfaction through collective improvement of on-site construction. Kwok and Hampson study found that relationship attributes such as trust, commitment, communication, fair profit and joint problem solving are positively and significantly related with on-site construction performance. However it is unlikely that collaborative working methods in themselves will produce promised gains until sub-contractors are fully integrated into the process (Hughes et al., 2006). Francis and Hoban (2002) demonstrated that lack of alliance experience, complexity of legal arrangements

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and the high cost of implementation are main reasons for non-inclusion of sub-contractors in alliances. Therefore, the main objective of this study is to propose a strategy for integrating sub-contractors, using lean supply principles which should ultimately improve construction project performances.

The study uses a combination of literature analyses and case study findings to develop a conceptual framework for integrating sub-contractors in an alliance environment. The review was used to analyze the significant issues in sub-contractor management and practical solutions that lean principles could provide to alliance environments. The case study on the other hand, provides evidence to support the view that downstream supply chain participants are fragmented compared to upstream supply chain participants in alliance contracts. The study therefore determines how the downstream can be integrated with the upstream participants in an alliance environment.

LITERATURE REVIEW

Current status of sub-contractors in construction

Sub-contractors are a vital component of construction projects (Yin et al., 2009) because the major aspects of project works are performed by the sub-contractors (Andreas et al., 2009). With increasing complexities of construction projects (Ahuja et al., 1994) and improved procurement systems, the main contractors' roles have become limited to the management of work interfaces while offering physical execution of construction tasks to sub-contractors (Humphreys et al., 2003). Sub-contracting is therefore an extensive tool in project delivery. In different countries and in different circumstances the involvement of sub-contractors in project execution range from about 60-95% as shown in Table 1.

Table 1: Sub-contractors' contribution in construction

Author	Country	Contribution %
CONSTRUCAO magazine as cited in Ohnuma, et al., (2000)	Brazil	95% of the considered companies were using sub-contracted in at least one activity
Anitablian and Cardoso as cited in Ohnuma, et al., (2000)	Not mentioned	In 15 studies, 100% sub-contract at least one service, 33.3% sub-contract all services
Lehtonen (1998)	Finland	90% of project value
Maturana, Alarcón, Gazmuri, & Vrsalovic (2007)	Chile	60 % - 70% of the project value

A survey of the Australian construction industry found that sub-contractors consistently work for the same contractors and 94% of these sub-contractors have worked with not more than three major contractors (Francis and Hoban, 2002). Another survey found that 41% of commercial sub-contractors have maintained steady relationships for an average of 9.2 years, with their main contractors (Costantino and Pietroforte, 2002). These suggest the existence of informal alliances between main contractors and sub-contractors which the construction industry could benefit from, if the industry recognizes it as so.

Obviously there are pros and cons to sub-contracting. Usdiken (1988) argue that increased sub-contracting may reduce the main contractor's control over the construction process and could lead to cost and time overruns. Non-completion of construction projects has been attributed to sub-contractor delays (Alarcón et al., 2005). Ohnuma, et al., (2000) also suggest that the sub-contractors mainly focus on work completion with little concern to material wastages and work quality, because sub-contracted services are paid on the basis of physical production at a fixed price. Therefore the relationship between main contractors and sub-contractors are potentially adversarial and may not

augur well for projects (Wood and Ellis, 2005). Conversely, interdependence between main and sub-contractors help to maintain a high degree of control over the activities of sub-contractors. Newer management philosophies promoting relational and collaborative working such as alliances and lean construction (Maturana et al., 2007) could be made to reduce perceived adversaries between contractors and sub-contractors (Gadde and Dubois, 2010)

Sub-contractors' position in alliance

Alliances and partnership contract types emerged to reduce adversarial contractual relationships and other effects of fragmentation in the construction industry (Davies, 2008). The alliance team selection strategy is based on both objective (skills, experience, track record) and subjective (behavior, attitude) criteria (Morwood et al., 2008) and are not based on price competition (Hensley, 2009). Morwood, et al. (2008) suggests that this selection strategy promotes self-awareness, awareness of other participants, team development and communication which are critical success factors in construction projects.

There is a significant component of price competition in alliance contracts, for example sub-contract works in alliances are awarded through some form of competitive bidding (Victorian Government, 2006). On the other hand alliances provide transparent legal and commercial framework and incentives for its participants through an open book concept (Ross, 2003). However such transparency does not extend to sub-contracts (Ross, 2003). Transparency may induce high bargain power to sub-contractors in negotiating further price increase and/or prevent the main contractor from any price reduction. Huang, Huang, Lin, and Ku (2008) suggest that some interface problems could arise due to the lack of trust and ineffective communication among project participants when sub-contractors are not integrated into the main alliance.

Payment disputes mainly due to severe competition and fixed price payments could be eliminated through the gain:pain share mechanism in alliances (Tang et al., 2006). This gain:pain share mechanism maximizes all key results areas. However this mechanism does not flow on to sub-contractors, thus the motivation for continuous improvement to work process is reduced. Sub-contractors are not able to share cost savings with main contractors under alliance agreements. This independence could lead to win-loss situations in alliances. Although there is a well-defined hierarchy of participation and collaboration of owner and non-owner participants towards the realization of project objectives, in alliance contracts, but very often these do not develop into long-term business relationship because the majority of construction projects are one-offs (Brown et al., 2001).

Latham (1994) makes a number of recommendations for improving relationships between main contractors and sub-contractors, one of which is to involve sub-contractors earlier on any project. Latham believes early involvement of sub-contractors on projects could develop greater team working throughout the project life cycle and beyond. But in alliance projects, sub-contractors and suppliers are introduced to the alliance at the project execution stage, meaning that sub-contractors are not a party to the alliance formation and other design development activities. Ross (2003) asserts that maximum participation and innovation could only be gained when sub-contractors and suppliers contribute to the design phase.

In summary, sub-contractors and suppliers are relegated to the downstream in alliance contracts, and there is no clear cut mechanism to monitor their relationship and performance within alliances. Keeping sub-contractors at arm's-length and operating a

transactional relationship which is mainly built on the lowest bid between subcontractors and alliance participants could impact on project performance.

Lean supply principles

In recent years, the application of lean principles is being promoted within the construction industry to help minimize waste and maximize value. Hines, Holweg, & Rich (2004) noted that management strategies could easily be integrated into lean without contradicting the strategic objective of lean to provide customer value. Lean is only truly effective when it focuses on the entire supply chain. The authors believe that some identified lean supply principles could be applied to the supply chain in alliance contracts to maximum benefits.

Some of the useful characteristics of lean supply pooled from literature are listed in Table 2. The lean supply principles identified were applied in the development of a sub-alliance model, which is discussed later on. Emphasis in lean supply principles is placed on the role that a supplier (in this case sub-contractor) could play in ensuring a desired value stream in project management. The principles require a high degree of supplier innovation and coordination in both product development and production processes. In fact the principles suggest collaboration in product development through group-based supplier development tools. Some other suggestions include the introduction of production control based techniques such as just-in-time concept, improved flexibility and synchronisation of supplier-customer capacities and improved inter-organizational relationship to achieve a win-win for all stakeholders.

Table 2: *Lean supply characteristics (Bozdogan and Horng, 2007)*

Nature of competition	Focus on the total competitiveness of a value stream
	No competition between the members of a supply chain
	Dependent upon partnerships, trust, openness, and profit sharing
Supply structure	Number of suppliers is low and very stable
	Long term, often lifetime, relations
	Buying criteria is based on maximum network benefit
The role of suppliers	Early involvement of established supplier in the design process
	A tiered and defined supply structure
	A high degree of supplier innovation in both new products and processes
Supplier development	The supplier is a leader of technology in the area
	A high level of supplier coordination at each level of the supply structure
	Suppliers within value streams are seen as group
Data interchange and interaction	Greater effort made by customer to develop their suppliers
	Pursue perfection by continually removing waste along value stream.
	True transparency in costs and capacity
Production principles	Detailed, some strategic, within network
	Very frequent interaction at operational level, spreading through network
	True just-in-time
	Synchronised capacity
	Flexibility to operate with fluctuations

METHODOLOGY

The objective of this paper is to demonstrate how sub-contractors management practices can be reorganized in alliance contracts. The research is an exploratory study using a

case study project executed under the alliance procurement system. Questions asked from a lean philosophy perspective include but not restricted to the following. How do existing sub-contractor management practices in an alliance contract create wastes? How are wastages created (causes for waste)? How can these wastages be eliminated through a reorganization of sub-contractor management practices? Are lean supply philosophies, when applied, able to improve existing sub-contractor management practices?

The paper begins with a review of relevant literature to support ideas on the current status in sub-contractor management. There is also reference made to lean supply principles to give an indication of its usefulness in supply chain management. The study presents brief information of a construction project being executed under an alliance procurement system, for comparison with the literature reviewed. After an initial pilot investigation, some deficient aspects of key processes on the case study project were identified and recommendations for improvement were made to the participating organization. The discussion section on integrating sub-contractors in alliances presented later on is largely based on these suggested improvements. Finally a framework incorporating sub-alliance processes into the main alliance framework is developed as a suggested improvement to the alliance procurement system.

CASE STUDY FINDINGS

Brief description of the case study project

The project studied is the replacement project of an existing motorway in Auckland, New Zealand. Due to concerns of robustness to seismic events and its increasing inability to cater for peak traffic demand, it was proposed to replace the motorway with a stronger and wider structure. The project commenced in 2009 and scheduled to be completed in 2013. The new structure is to be built with minimal effect to traffic flow as this is a crucial motorway link. It is a segmented structure built from 468 precast concrete sections constructed off-site and moved into place with a lifting gantry truss. The project is delivered by seven organizations and the local government body via an alliance approach. Several work packages and processes were identified on the project, by a larger research programme undertaken by the authors to investigate wastes and value creation on the project. However only two of these processes are presented here to support the view that downstream supply chain participants (sub-contractors and suppliers) need to be integrated into alliance contracts for improved benefits.

Process study 1

The process involves the production of precast concrete segments needed for bridge replacements. The entire process (precast concrete segment) consists of fabrication of the rebar, mould set up, concrete pouring and other remedial works. The fabrication of re-bar cage sub-process is awarded on a pre-agreed fixed price to a specialist sub-contractor to provide for labour and materials for this sub-process.

Process study 2

The second process studied is the construction of parapet walls for a section of the motorway. The process consists of the installation of precast concrete elements, installation of parapet formwork, concrete pour and removal of formwork. This entire process is sub-contracted on a labour only basis to another subcontractor.

Findings on process study 1

The average cycle time for the re-bar cage fabrication sub-process is 540 minutes which is approximately 20% of the total cycle time of the entire precast segment. The process

study conducted found that 45% of the cycle time for the re-bar cage fabrication process was spent on waste activities. These waste activities include rework, unnecessary motion/transport and waiting. Improvement opportunities existed in this sub-process around re-bar steel identification and handling, job-site layouting and process delays due to material and equipment unavailability. Furthermore, there were different constructability issues during the construction phase probably because the sub-contractor was not part of the design team at the design development phase.

The process study found that there were aspects of the sub-process which the main contractor engaged itself in, which were specifically the sub-contractors responsibility and being paid for it. Obviously task responsibilities were not well communicated and performance monitoring was lacking in this sub-process. The subcontractor did not prepare the work schedules and was not participating in the regular 'lesson learned' workshop, where his ideas could be communicated to other project participants.

The improvement opportunities were discussed with alliance management, but these could not be directly implemented because it concerned a sub-contractors' process which was out of their control. There was also little incentive to influence any change in sub-contractor's activities because the sub-process (re-bar fabrication) was awarded at a fixed price, and was not on the critical path.

It is apparent that the benefits of team-working among upper tier parties are not transmitted down the supply chain. Also sub-contractors are unable to visualize how marginal improvements could benefit the entire project. The study reveals that sub-contracting firms are very often kept at arm's length by other project participants on alliance contracts.

Findings on process study 2

The process study revealed that 49% of the total cycle time was contributed by non-value adding activities. The non-value adding activities included poor workmanship, layout, ineffective material handling and ineffective work methods. It was apparent from the study that the sub-contractor handling this work process placed more emphasis on effective rather efficient work performance. The terms of engagement did not provide any direct benefit for efficient work methods nor for high levels of performance. Incentives provided in the alliance contract for performance improvements do not diffuse down the supply chain to motivate the downstream to reduce process wastes.

It was observed that the main contractor implemented process controls such as a daily monitoring of production and comparison with planned targets, and subsequently monthly forecasting of the entire financial performance of the process. However the process incurred excesses over the original budget and under the original time schedule. The process study determined that rework activities accounted for 17 % of the total non-value adding activities. The main reason for reworks was the poor workmanship of the unskilled worker supplied by the sub-contractor.

Observations drawn from the process studies

The process studies carried out on both work processes provide evidence that wastes are generated within alliance contracts through work processes carried out by sub-contractors. Opportunities for improvement are not being exploited by alliance management because of the poor integration of the lower with upper tier project participants in alliance contracts. Furthermore, the terms of engagement of sub-contractors on this alliance project mean that price and previous working relationships were the major determinants in the contracts. Previous working relationships have the

advantage of fostering trusts and interdependence, so that commitment towards waste reduction could come naturally. However it is apparent from the study that the alliance framework does not offer any tangible incentives for sub-contractors to commit to such objectives. Furthermore, the alliance had excluded domestic sub-contractors at the design development phase, thus losing any innovative contribution of these sub-contractors at the design phase. Although effort was made by the main contractor to keep sub-contracting teams informed of alliance decisions, but better integration and coordination could have been realized if they were party to key decisions in the alliance project.

The process study revealed that sub-contractor management practices in alliance are a cross-over between traditional and lean supply systems. Table 3 gives a comparison of sub-contractor management in the observed processes in alliance project and lean supply. We note that by extending alliance principles down the supply chain, observed points of departure could be minimised and the opportunities for process improvements become more realizable.

The next section presents a framework that attempts to integrate sub-contractor management practices into an alliance framework. The suggested framework was developed on the premise that project participants must be able to form symbiotic working relationships (Maturana, Alarcón, Gazmuri, & Vrsalovic, 2007) from the early phase of any project.

Table 3 Comparison of sub-contractor's management in real alliance and lean supply

Factor	Sub-contracting in alliance	Lean supply system
Selection criteria	Price and past working experience	Past performance
Transparency	No transparency in cost figures	Information (technical & cost) sharing
Contract time	Informally long term	Long term
Involvement of product	No/very little	Involved
Knowledge of supplier	Very limited	Greater awareness
Relationship	Arm length, project basis	Closer and long term
Level of trust	Lack of trust	Practices taken to reinforce trust
Behaviour	Win- loss	Win- win
Incentive to cost saving	One party	Both party
Communication	Work independently	Open and frequent
Competition	High	Mutual assistance
Hierarchy	Well defined	Well defined tiered structure

FRAMEWORK DEVELOPMENT

In meeting with the objective of the study, which is to reorganize subcontractor management activities, this section describes the framework that is suggested towards achieving this objective. The status quo on most alliance projects generates a lot of waste because of the lack of integration of key domestic subcontractors into the alliance framework. Figure 2 shows a framework that interconnects sub-contractors with the alliance team. For convenience, we refer to the add-on as a sub-alliance to any existing alliance framework. The sub-alliance enters the alliance environment during the pre-project planning phase and carries on to project execution and to the post project review phase. The following presentation of the implementation steps offers a framework for developing the tools needed to assist in its adoption.

In order to identify potential sub-contractors, the potential main alliance members would be required to nominate sub-contractors (whether specialist or key domestic) who could

contribute to the alliance. This is the stage where previous relationships come into play and expectedly nominations will be on the basis of proven performance and a demonstration of their capacity to contribute. Main contractors' would issue request for proposals from their sub-contractors and thence provide manageable list of existing sub-contractors for further investigation.

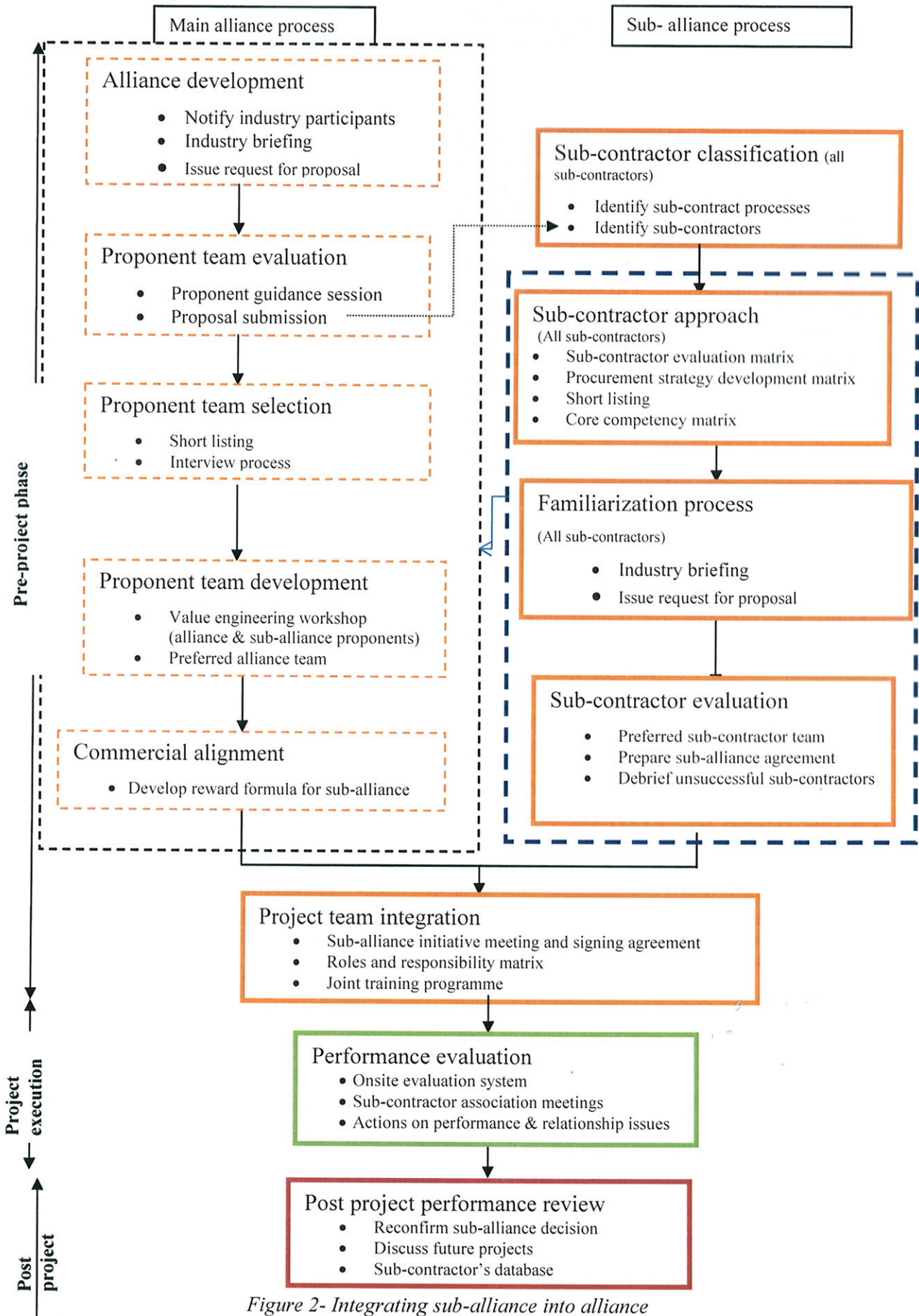


Figure 2- Integrating sub-alliance into alliance

After all proposals have been submitted, potential main alliance and sub-alliance participants are identified based on the capacity analysis of the main alliance participants. Sub-contract processes are identified after a formal evaluation but before the formal selection of the main alliance team by the project owner. When the 'teaming and selection' phase is completed and in parallel to the 'commercial alignment' phases of the main alliance, the sub-alliance team may be brought into the picture of things. The risk and value of each process would have been identified at this stage. High risk and high value processes are selected for consideration by the larger team including the sub-alliance members. The outcome of this activity is a procurement strategy matrix and a sub-contractor competence matrix. The main alliance proponent selection workshop could be used to develop a standard for sub-contractor evaluation and selection. Non-price parameters such as technical and managerial competence, past cognate experiences, innovation, and financial viability of these organizations could be determined and weighted at this stage. This is a sub-contractor evaluation matrix which improves transparency and eliminates the negative effects of price competition.

Project-specific factors, sub-contractor evaluation criteria along with the qualifications of sub-contractors are considered and a short list is drawn of potential sub-contractors suited for the project.

At the commercial alignment phase of the main alliance, the alliance members would need to develop a reward formula for sub-contractors which aligns with the main alliances' key performance (KPI) system. This reward formula could be negotiated with the sub-contractors during their selection. The reward formula allows the win-win approach to profit sharing and open book accounting to extend to the sub-alliance team. Short listed sub-contractors would therefore be part of the initial project introduction where the selection criteria and reward mechanisms are explained. Key alliance members will explain project expectations and other opportunities to sub-contractors, who may be required to indicate their strategic objectives for participating in the project. Subsequently all short listed sub-contractors in the newly formed sub-alliance would be involved in all value engineering workshops. The quality of outputs during these workshops would be enriched through innovative contributions by the sub-alliance team. Their early involvement should build trust, strong relationships and commitment throughout the value chain.

Later the alliance proponent members evaluate all proposals. The list of sub-contractors with indication of their quoted prices is considered, while key alliance members comment on their suitability. The core competences of each of the sub-alliance team are listed and they are assigned roles depending on their relevant skills. Further selection procedure may involve workshops to reconcile the various sub-contractor priorities and feedbacks. Provisional agreements are prepared using the strategic objectives of each participant and distributed among selected sub-alliance members before the project kick-off meeting. A time period may be allowed for the overall alliance to come up with any change so that agreements are finalized before the kick-off meeting. It would be helpful to organize a session with unsuccessful applicants to explain where they went wrong. Alliance board members may conduct this session in the presence of the project owner.

After the selection of sub-contractors, all the alliance members and sub-alliance members are invited to the sub-alliance initiative meeting. At the meeting, alliance

members need to reconfirm their commitment to the project by presenting their responsibilities/objectives for the projects and their appropriateness for the work. Final outcome of this activity is to develop roles and responsibility matrix for all project participants. Although individual activities allocated are the key responsibility of each participant, all members must ensure that the project progresses. The final agenda of the sub-alliance initiative is the signing of the sub-alliance agreements by relevant parties. Joint training programmes are to be organized to meet the technical and managerial aspects of the project and to align these with the KPIs. Training programmes should be relevant to problems identified during performance evaluations and would enable participants to see things differently, do things differently and uncover potentials. Intercompany training events should be conducted during project execution to exchange best practices.

Key alliance participants would continuously evaluate the activities of the sub-alliance and the evaluation results could be used as references for future projects. The main contractor who is directly linked with any sub-contractor could assess their performance and could use the 'expressions' evaluation system that has three mood states in different colors namely: happy, indifferent and sad (in green, yellow and red respectively). The main advantage of this evaluation system is that everyone is able to monitor their performance throughout the project. These performance feedbacks should aid the training development plan. Immediately after the feedback, the sub-alliance team would be required to share information, discuss the project plans, and generate ideas. Consecutively, relationship status monitoring could be ongoing to assess alliance participants' as perceived by other participants. An alliance participant's score questionnaire could be distributed at monthly sub-alliance meetings where they assign performance scores to other members and changes in the score can be openly discussed. Depending on the performance, the training programmes will be developed in a technical or managerial scope to improve the performance. For technical issues, continuous improvement meetings may be conducted among participants to analyze issues. New suggestions may be introduced and the best alternative implemented. This should be a main agenda at the sub-contractor association meeting. Post project performance review meetings will be conducted with all alliance members to review value addition from the sub-alliance team. The performance of each sub-alliance team member is reviewed against set KPIs and strategic objectives agreed at the beginning of the project. At this meeting, the participants should actively discuss the opportunities for future alliances. At project completion stage, alliances should consolidate previous periodic evaluations and lessons learned in a central database for future alliance projects.

CONCLUSION

Alliances projects are established to remove common barriers in traditional procurement methods by encouraging maximum contribution of every project participant to achieve successful outcomes. However it is usual to leave out sub-contractors from the main alliance even though a major portion of physical execution is undertaken by them. It is imperative that the expertise of these key participants (sub-contractors) be integrated into the main alliance to ensure commitment throughout the project value chain. This paper suggests a framework which allows the establishment of a sub-alliance team in tandem with the objectives of core alliances. The authors believe that an extension of alliances to include some selected sub-contractors would augur well for alliance projects. The framework promotes the selection and formation of the sub-alliance teams using similar criteria to those of core alliance teams. Such criteria are usually non-price based, but based on criteria such as innovativeness, ability to collaborate and the

alignment of strategic objectives with KPIs identified for the proposed alliance project. An important objective of the suggested framework is the culture shift towards an incentive system that could guarantee a win-win for all project participants. Systematic evaluation of performances and relationships through evaluation indices are suggested in the new framework. It is hoped that the opportunity created by early involvement of key sub-contractors will enhance overall alliance project objectives. Further studies are needed to validate the framework by testing its feasibility in a real alliance contract.

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REFERENCES

- AHUJA, H. N., DOZZI, S. P. & ABOURIZK, S. M. 1994. *Project management: techniques in planning and controlling construction projects*, NY, Wiley.
- ALARCÓN, L. F., DIETHELM, S., ROJO, O. & CALDERON, R. Assessing the impacts of implementing lean construction. International Group for Lean Construction,(IGLC)-13, 2005 Sidney, Australia,. International Group for Lean Construction, 387-394.
- ANDREAS, H., FLORENCE, Y. Y. L. & JANE, S. H. T. 2009. Relative Importance of Subcontractor Selection Criteria: Evidence from Singapore. *Journal of construction engineering and management*, 135, 826-832.
- BOZDOGAN, K. & HORNG, T. C. 2007. *A comparative analysis of supply chain management practices by Boeing and Airbus: long-term strategic implications*. Masters thesis, Massachusetts Institute of Technology, .
- BROWN, D. C., ASHLEIGH, M. J., RILEY, M. J. & SHAW, R. D. 2001. New project procurement process. *Journal of Management in Engineering*, 17, 192-201.
- COSTANTINO, N. & PIETROFORTE, R. 2002. Subcontracting practices in USA homebuilding--an empirical verification of Eccles's findings 20 years later* 1. *European Journal of Purchasing & Supply Management*, 8, 15-23.
- DAVIES, J. P. 2008. *Alliance Contracts & Public Sector Governance*. Degree of Doctor of Philosophy, Griffith University.
- FRANCIS, V. & HOBAN, A. 2002. Improving contractor/subcontractor relationships through innovative contracting. *10th Symposium Construction Innovation and Global Competitiveness*. CRC Press.
- GADDE, L. E. & DUBOIS, A. 2010. Partnering in the construction industry--Problems and opportunities. *Journal of Purchasing and Supply Management*.
- HENSLEY, G. 2009. Can conversion from traditional to alliance based defence procurement models work?
- HINES, P., HOLWEG, M. & RICH, N. 2004. Learning to evolve: A review of contemporary lean thinking. *International Journal of Operations & Production Management*, 24, 994 - 1011.
- HUANG, R. Y., HUANG, C. T., LIN, H. & KU, W. H. 2008. Factor analysis of interface problems among construction parties—a case study of MRT. *Journal of Marine Science and Technology*, 16, 52-63.
- HUGHES, W., HILLEBRANDT, P. & GREENWOOD, D. 2006. *Procurement in the construction industry: the impact and cost of alternative market and supply processes*, NY,USA, Taylor & Francis Group.

- HUMPHREYS, P., MATTHEWS, J. & KUMARASWAMY, M. 2003. Pre-construction project partnering: from adversarial to collaborative relationships. *Supply Chain Management: An International Journal*, 8, 166-178.
- KWOK, T. L. & HAMPSON, K. D. Strategic Alliances Between Contractors and Subcontractors—A Tender Evaluation Criterion for the Public Work Sectors. Construction process re-engineering : proceedings of the International Conference on Construction Process Re-engineering, 14-15 July 1997 1997 Gold Coast, Australia., 671-684.
- LATHAM, M. 1994. Constructing the Team (the Latham Report). *Industry Review of Procurement and Contractual Arrangements In The UK Construction Industry HMSO, London*.
- LEHTONEN, W. T. (ed.) 1998. *Improving sub-contracting of the construction industry by participatory cooperation*, Oxford, UK: Elsevier science.
- MATURANA, S., ALARCÓN, L. F., GAZMURI, P. & VRSALOVIC, M. 2007. On-site subcontractor evaluation method based on lean principles and partnering practices. *Journal of Management in Engineering*, 23, 67.
- MILES, R. S. Alliance Lean Design/ Construction on a small high tech project. International Group for Lean Construction (IGLC-6), 1998 Guarujá, Brazil. 27.
- MORWOOD, R., SCOTT, D. & PITCHER, I. 2008. *Alliancing a participant's guide* Queensland, Australia., Maunsell AECOM.
- OHNUMA, D. K., PEREIRA, S. R. & CARDOSO, F. F. The Role of the Subcontractors in the Competitiveness of Building Companies and the Integration of Value Chains. Proceedings of the CIB W92 Procurement System Symposium., April 24 – 27 2000 Santiago, Chile. 201-218.
- ROSS, J. March 23, 2010. Introduction to Project Alliancing- On engineering and construction projects. Alliancing contract conference, March 23, 2010 2003 Sydney, Australia.
- TANG, W., DUFFIELD, C. F. & YOUNG, D. M. 2006. Partnering mechanism in construction: An empirical study on the Chinese construction industry. *Journal of Construction Engineering and Management*, 132, 217-229.
- USDIKEN, Z. S. B. 1988. Strategies and boundaries: subcontracting in construction. *Strategic Management Journal*, 9, 633-637.
- VICTORIAN GOVERNMENT 2006. Project Alliancing Practitioners' Guide.
- WOOD, G. D. & ELLIS, R. C. T. 2005. Main contractor experiences of partnering relationships on UK construction projects. *Construction Management and Economics*, 23, 317-325.
- YIN, H., WANG, Z., YU, J., JI, Z. & NI, H. 2009. Application of DEA Cross-evaluation Model in Project Dynamic Alliance Subcontractors Selection. *IEEE*, 1-4.