

## A FRAMEWORK FOR SUBCONTRACTOR INTEGRATION IN ALLIANCE CONTRACTS

Nimesha Vilasini, Auckland University of Technology, New Zealand  
Thomas R. Neitzert, Auckland University of Technology, New Zealand  
James O. B. Rotimi, Auckland University of Technology, New Zealand  
Abimbola O. Windapo, University of Cape Town, South Africa

### ABSTRACT

*Project alliancing involves the active collaboration of construction project owners and non-owner participants (designer, contractors, and suppliers) to deliver projects in an atmosphere of shared responsibilities and liabilities. Alliancing connotes integration 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 subcontractors are very often left out of the key alliance. Therefore this study identifies improvement areas to current alliance practice and suggests changes that will permit critical sub-contracting processes to be integrated into a project's main alliance. To achieve this objective the research follows a comparative study approach. Information obtained from relevant literature is used to identify current subcontractor management practices and best practices for subcontractor integration in alliances. A case study of an alliance project is used to identify improvement areas in subcontractor management practices in an alliance environment. From these findings, the study proposes a revised alliance framework that integrates subcontractors from the early stages in alliance contracts, thus enabling the realisation of benefits accruable to projects through early contractor involvement.*

**KEYWORDS:** Alliance, Alliance framework, Sub-alliance, Subcontractor integration.

### INTRODUCTION

In projects executed using the alliance procurement system, project owner(s) 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 practices show that for most projects the focus is on an alliance between the key project participants (owner, design team and main contractor) but with few projects involving subcontractors. The integration of subcontractors in alliances has been done on a project by project basis, however where subcontractors have been integrated into alliances, good project performances were recorded (Miles, 1998).

Kwok and Hampson (1997) showed that strategic alliances between contractors and subcontractors produce superior client satisfaction because of the overall improvement of on-site construction activities. Kwok and Hampson's (1997) study concludes that relationship attributes such as trust, commitment, communication, fair profit and joint problem solving are positively and significantly related with on-site construction performance. Though Hughes et

al., (Hughes, Hillebrandt, & Greenwood, 2006) admit that it is unlikely that collaborative working methods in themselves will produce promised gains without the full integration of subcontractors into the process.

Alliance contracts require considerable time for their formation and are generally complex. Such complexities could be minimized by keeping the size of the alliance team to manageable numbers. Francis and Hoban (2002) demonstrated that the complexity of legal arrangements involved in alliance procurement systems and the high cost of its implementation are the main reasons for the non-inclusion of subcontractors in alliances. However there are benefits to the integration of critical subcontractors in alliances which this study will expound later. The main objective of the study is to suggest a framework whereby critical subcontractors are introduced early into the main alliance environment. The authors believe such an approach will allow for proper integration which could ultimately improve construction project performances.

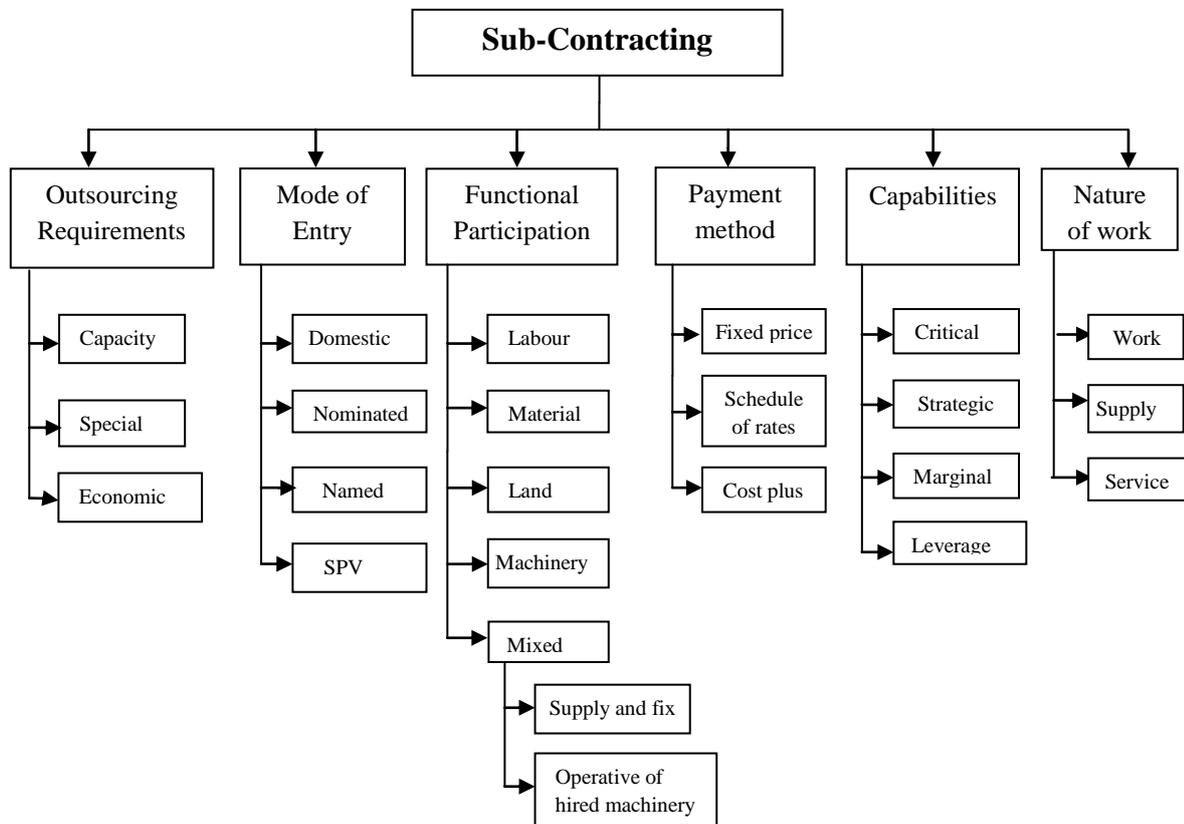
The study uses a combination of literature analyses and case study findings to develop a conceptual framework for integrating subcontractors in an alliance environment. The review is used to analyse the significant issues in subcontractor management and the practical benefits of their early inclusion in alliance environments. The case study presents the level of integration of supply chain participants on a typical alliance project. The investigations reveal the fragmentation of downstream supply chain participants when compared to their upstream counterparts on the case study project. This serves to buttress the need for an improved system whereby the downstream is integrated with the upstream participants in alliance environments.

## BRIEF LITERATURE REVIEW

The term sub-contracting has ambiguous definitions depending on the industry from which it is viewed and the terms subcontractor and supplier are frequently used interchangeably (Lehtinen, 2001). The term 'subcontractor' instead of 'supplier' has tended to be used in operations which have been considered as a temporarily excess production requirement or performed by more than one participant. Traditionally, the term 'sub-contracting' is used in construction projects when a main contractor exists. Another notable difference is that subcontractors' products are a part of the end product, whereas suppliers' products are basic inputs for construction. In this study, we define a subcontractor as a business entity which has a contract agreement with a main contractor to provide a portion of the work, material input, or services on a project which the contractor has agreed to perform.

Sub-contracting arrangements are mainly categorised on the basis of outsourcing decisions at project onset, mode of entry, functional participation, payment methods and their capabilities. This general categorisation is illustrated in Figure 1. Therefore sub-contracting on the basis of outsourcing requirements depends on capacity, specialisation and economic justification. Subcontractors may be nominated, named and domestic subcontractor according to their mode of entry into a construction contract (Masrom & Asrul, 2007). In which case, the nominated subcontractor is selected by the client while the domestic subcontractor is selected by the main contractor. Named subcontractor is a combination of the nominated and domestic where client selects the subcontractor and the main contractor is responsible for the named contractor's work and payments. By mode of entry and unique to the alliance procurement

system is the establishment of a special purpose vehicle (SPV) to streamline the establishment and management of third party contracts (Victorian Government, 2006). Other categorisation of sub-contract works include categorisation by capability profile (Lehtinen, 2001) functional participation (Tam, Shen, & Tam, 2007), methods of payment (Ramus, Birchall & Griffiths, 2006), and nature of work rendered on a project (Ramus et al., 2006).



**Figure 1: Sub-contracting categories**

Irrespective of the categorisation discussed, subcontractors are a vital component of construction projects (Yin, Wang, Yu, Ji, & Ni, 2009) because major aspects of construction project works are performed by them (Andreas, Florence, & Jane, 2009). With increasing complexities of construction projects (Ahuja, Dozzi, & Abourizk, 1994) and improved procurement systems, main contractors' roles have become limited to the management of work interfaces while offering physical execution of construction tasks to subcontractors (Humphreys, Matthews, & Kumaraswamy, 2003). Sub-contracting is therefore a preferred option in project delivery with their input ranging from about 60-95% in different countries and in different circumstances (Lehtonen, 1998; Maturana, Alarcón, Gazmuri & Vrsalovic, 2007; Ohnuma, Pereira & Cardoso, 2000).

Informal alliances exist between contractors and their subcontractors which the construction industry could benefit from. For example, most subcontractors consistently work for the same contractors and 94% of subcontractors in Australia have worked with not more than three major contractors (Francis & Hoban, 2002). Another survey found that 41% of commercial subcontractors have maintained steady relationships with their main contractors for an average of 9.2 years (Costantino & Pietroforte, 2002).

However, there are benefits and disadvantages of sub-contracting. For example, Usdiken (1988) argues 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 have also been attributed to subcontractor delays (Alarcón, Diethelm, Rojo, & Calderon, 2005). Ohnuma, et al., (2000) suggests that the subcontractors' main focus is on work completion with the least attention to material wastages and work quality. This could be because sub-contracted services are paid on the basis of physical production at a fixed price.

Therefore the relationship between main contractors and subcontractor are potentially adversarial and may not augur well on some projects (Wood & Ellis, 2005). Though, interdependence between the main contractor and subcontractors help to maintain a high degree of control over project activities. Integration of key project participants from the design phase of construction projects has long been recognised in the industry and could reduce perceived adversaries between contractors and subcontractors on projects (Gadde & Dubois, 2010).

Relational based project delivery systems adopted by different countries such as early contractor involvement in the UK, integrated project delivery in the USA and alliancing in the Australasian region, all describe some form of integration in the supply chain. However these relational contracting systems are very often limited to the client, main contractor and designers. The authors believe that early integration of subcontractors within projects can provide opportunities for them to offer their expertise and so maximise potentials for cost savings. Subcontractor integration could also assist with timely completion, improved quality, enhanced performance in environmental issues, health and safety, and innovativeness (Eriksson & Westerberg, 2011). A common underlying theme of subcontractor integration is early involvement through value management workshops to leverage their knowledge and experience to improve performance on a proposed project. The study suggests a framework which will extend relational contracting principles to key subcontractors in alliance contracts. The following sections focus on the subcontractors' roles in an alliance environment.

### **Subcontractors' Position in Alliances**

Alliance contracts 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 (behaviour, attitude) criteria (Morwood, Scott, & Pitcher, 2008) and are not based on price competition (Davies, 2008). Therefore this selection strategy promotes self-awareness, awareness of other participants, team development and communication, as critical success factors in construction projects (Morwood et al., 2008).

Alliances provide a transparent legal and commercial framework and offers incentives to its participants through an open book concept (Ross, 2003), though very often such transparency do not extend to sub-contract works (Ross, 2003). It may be argued that transparency could induce high bargain power to subcontractors thus preventing main contractors from realising increased margins for their management activities. However some interface problems could arise from lack of trust and ineffective communication among project participants if subcontractors are not integrated into the main alliance (Huang, Huang, Lin, & Ku, 2008).

Alliance contracts involve a gain:pain share mechanism that maximises all key result areas on projects. Thus payment disputes as a result of severe competition and fixed price payments could be eliminated through this gain:pain share mechanism (Tang, Duffield, & Young, 2006). Presently this mechanism does not flow on to subcontractors because they are not a party to the alliance formation and other activities at the design development phase. Subcontractors are therefore not able to share cost savings with main contractors under alliance agreements. Thus the motivation for continuous improvement to work processes is reduced. Maximum participation and innovation could only be gained when subcontractors and suppliers contribute to the design phase of projects (Latham, 1994; Ross, 2003).

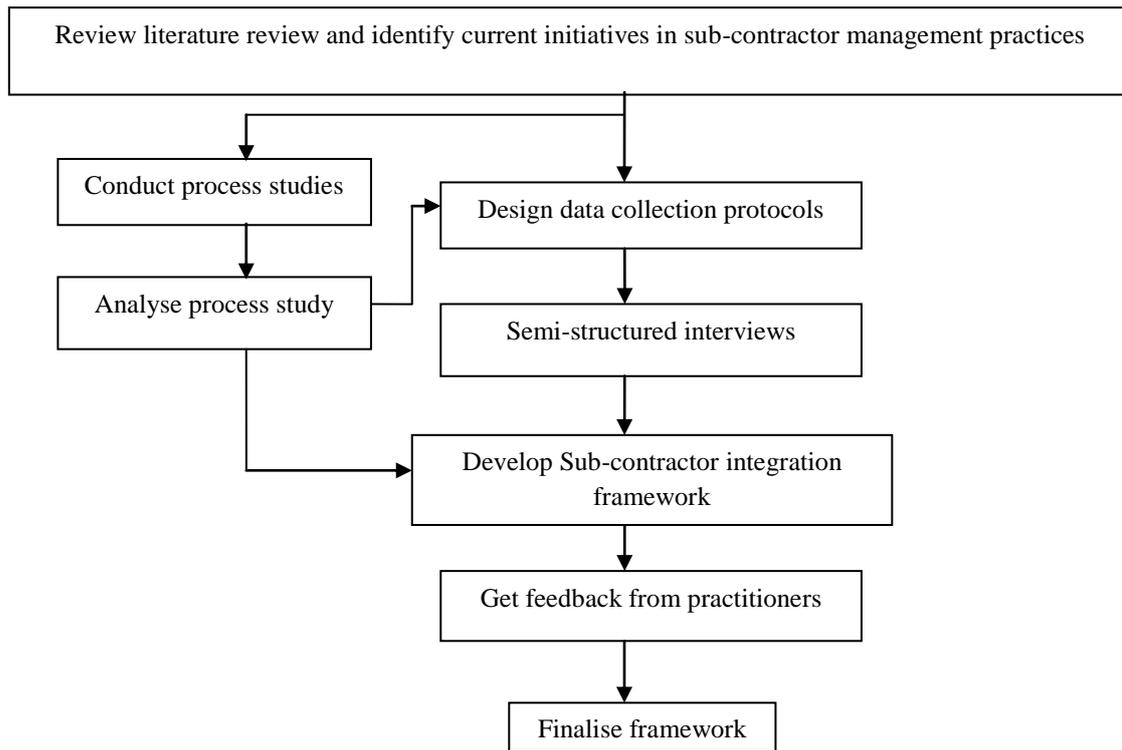
Another limiting factor to the full integration of subcontractors in alliances is the fact that alliances rarely do develop into long term business relationship because the majority of these construction projects are one-offs (Brown, Ashleigh, Riley, & Shaw, 2001). Thus subcontractors and suppliers are relegated to the downstream in alliance contracts, and without any mechanism to monitor their relationship and performance within this relational contracting method. Keeping subcontractors at arm's length and operating a transactional relationship which is mainly built on the lowest bid between subcontractors and alliance participants could impact negatively on project performance.

## RESEARCH METHODOLOGY

The paper intends to suggest a framework that reorganises the traditional alliance framework to include subcontractors. The research described is largely exploratory using a case study project executed under an alliance procurement system. Some of the research questions addressed by the study include: what is the nature of alliance contracts in practice? How well are critical subcontractors integrated into the main alliance environment? What indications are there that the current alliance practice is inadequate? How could perceived inadequacies be eliminated through a reorganisation of the current alliance framework? Are there obstacles to improving subcontractor involvement in alliance contracts?

The approach used in this study is schematically presented in Figure 2. The study begins with a review of relevant literature to support ideas on the current trends and initiatives in subcontractor involvement on construction projects. Then the study carried out a field inquiry on subcontractor management practices in a real alliance project (the case study described below). It used a process study methodology to identify improvement areas in key work packages which are sub-contracted within the project. Together with those data collections the case study observations and literature findings are combined to develop a framework for subcontractor integration in an alliance contract. These formed the basis for the questions prepared for semi-structured, validation interviews, in the next phase of the study programme.

The developed framework incorporates a sub-alliance process into the current main alliance framework as a suggested improvement. The framework developed in the first phase was validated in two ways. The first is an internal validation where the findings from the first phase were discussed with key management personnel on the case study project. The second validation involved an external validation using professionals who are knowledgeable in project procurement systems. However this paper presents only the result of the internal validation process.



**Figure 2: Methodological approach to the study**

### Brief Description of the Case Study Project

The case study project is the replacement works to an existing motorway bridge in Auckland, New Zealand. The replacement involves a stronger and wider bridge structure to enhance its robustness to seismic events and to cater for peak traffic demand. 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 commenced in 2009 and is scheduled to be completed in 2012. The project is delivered by seven organisations and the local government body via an alliance procurement approach. Several work packages and processes of the project were identified as part of a larger research programme undertaken by the authors to investigate wastes and value creation within the project. However only the result of investigations into two of these processes are presented here to support the view that downstream supply chain participants (subcontractors and suppliers) would need to be integrated into alliance contracts for improved benefits.

The first process studied involved the production of pre-cast concrete segments (process study one). The pre-cast concrete work process consisted of fabrication of the rebar cage, mould set-up, concrete pouring and remedial works. The rebar cage fabrication sub-process under the pre-cast concrete process was awarded at a pre-agreed fixed price to a specialist subcontractor to provide labour and materials. The second process studied involved the construction of parapet walls for a section of the motorway (process study two). This second process consisted of the installation of precast concrete elements, installation of parapet formworks, concrete pour and removal of formwork. This particular work process was sub-contracted on a labour-only basis to another subcontractor.

## RESULTS AND FINDINGS

### Summary of Findings of Process Study 1

The average cycle time for the rebar cage fabrication sub-process is 540 minutes which is approximately 20% of the total cycle time of the entire precast work process. The study of the process found that 45% of the cycle time for the rebar cage fabrication sub-process was spent on waste activities. These waste activities include rework, unnecessary motion/transport and waiting times. Improvement opportunities existed in this sub-process around rebar steel identification and handling, job-site layout and process delays due to material and equipment unavailability. Furthermore, there were different constructability issues during the construction phase, probably because the subcontractor was not part of the design team at the design development phase.

The study found that there were aspects of certain sub-processes which the main contractor became involved in, which were specifically the subcontractors' responsibility and being paid for it. It was obvious that task responsibilities were not well communicated and performance monitoring was lacking in this situation. It was observed that the subcontractor did not prepare the work schedules and was not participating in the regular 'lessons learned' workshops, where ideas could be communicated to other project participants.

The improvement opportunities identified by the study were discussed with the alliance management, but these could not be directly implemented because it concerned a subcontractor's process which was out of their control. There was also little incentive to influence any change in subcontractor's activities because the sub-process (rebar fabrication) was awarded at a fixed price, and was not on the critical path. It became apparent that the benefits of team-working among upper tier parties are not transmitted down the supply chain. Sub-contracting firms are very often kept at arm's length by other project participants within alliance contracts. Thus subcontractors are unable to visualize how marginal improvements could benefit the entire project.

### Summary of Findings of Process Study 2

The study of the second process revealed that 49% of the total cycle time was contributed by non-value adding activities. The non-value adding activities included poor workmanship, non-optimal layout, ineffective material handling and ineffective work methods. It was apparent from the study that the subcontractor handling this work process placed more emphasis on effective rather efficient work performances. The terms of engagement did not provide any direct benefit for efficient work methods nor for higher than normal levels of performance. Incentives provided in the alliance contract for performance improvements did not diffuse down the supply chain to motivate downstream participants 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. Although, the process was completed on time but it incurred excesses over the original budget. The process study determined that rework activities accounted for 17 % of the total non-value adding activities.

The main reason for rework was the poor workmanship of the unskilled workers supplied by the subcontractor.

### 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 aspects of work undertaken by subcontractors. Improvement opportunities are not being exploited by alliance management because of the poor integration of the lower and upper tier project participants in alliance contracts. Furthermore, the terms of engagement of subcontractors on this alliance project mean that price and previous working relationships were the major determinants in the contracts. Although previous working relationships have the advantage of fostering trust 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 subcontractors to commit to such objectives.

Furthermore, the alliance had excluded critical domestic subcontractors at the design development phase, thus missing out on any innovative contributions of these subcontractors at the design phase. Although efforts were made by the main contractor to keep subcontracting teams informed of alliance decisions, better integration and coordination could have been realizable if they were party to key decisions from the outset of the alliance project.

### Validation of Process Study Findings

In order to confirm the findings from the process analysis, the study undertook interviews with three senior management personnel involved in the alliance project. To preserve anonymity the interviewees are referred to as IT1, IT2 and IT3. The interview began by determining company practices in the engagement of subcontractors. The questions asked covered subcontract types, significance of the subcontracts and the way subcontractors are introduced to the alliance. The study found that there were 74 subcontractors engaged on the project with 17 involved in major work contracts and 28 on minor works and service contracts. A breakdown of the subcontract types is shown in Table 1.

**Table 1: Sub-contracts type distribution**

Subcontract type	Percentage of project
Minor services contract	17%
Works contract	23%
Supply contract	18%
Sub-consultant	15%
Plant hire contract	7%
Minor work contract	20%

According to IT1, subcontractors involved in ‘work contracts’ were paid on a schedule rate basis and other contracts were fixed price contracts. The total value of sub-contracts is 40% of the project cost and all the subcontractors were engaged at the construction phase of the alliance project. Compared with other countries the value of sub-contract percentage is low in New Zealand. IT3 confirms this in his transcribed statement below:

*It is interesting in New Zealand that all the major infrastructure contractors have significant work forces of their own and hence only sub-contract the smaller work packages. They find they have better project control when major works are not sub-contracted.*

Literature on sub-contracting identifies a number of different reasons for sub-contracting decision. Even though literature suggested that a sub-contracting strategy is chosen because it will provide higher quality, flexibility and cost savings, IT1 provided two contrary reasons. According to IT1 sub-contracting decisions in alliances are for the purpose of smoothening resources and spreading the project risk. In IT1 words:

*Generally, sub-contracts are used to smooth the resources. If enough labour is not available, sub-contracting is used. In addition, sub-contracting is also used to bring key skills and innovations to the project. Sub-contracting would be used as a tool to transfer a risk warrant to the sub-contractor as they have a defect obligation period.*

It is apparent from the interview that the modes of engagement of the subcontractors were not in alignment with the main alliance key result areas. IT1 suggested that the two main reasons for sub-contracting decisions on the alliance project were to smooth resources and spread the project risk. It could be argued that non-specialist subcontractors (used on this case study project) are incapable of dealing with the risks allocated to them.

IT1 suggested that all the subcontractors brought into the alliance had been selected from known subcontractors through a tender process. The main alliance contractors select subcontractors according to the complexity of the work and previous working relationships. The study findings tend to indicate that the criteria considered by alliances during the prequalification and bid process for subcontractor are health and safety performance, management capability and technical ability. When interviewed, IT1 stressed the importance of the safety factor as a selection criterion.

*Safety is probably the number one. Subcontractors have to fill out a questionnaire which mainly consists of safety related questions and they are assessed based on the answers. Since safety is high on the agenda, the alliance needs to select subcontractors who are at least able to satisfy the alliance standard. Even though the price is always a factor, we never sacrifice safety for the price.*

Therefore an alliance team must cooperate with subcontractors to build a team environment which will realise favourable project outcomes, without compromising safety and quality and which will not affect the subcontractors' return. Therefore more prominence on 'best value' approach rather than 'lowest price' approach is a prerequisite. The selection prerequisites are to be based on criteria including, waste reduction plan, previous project success, commercial and technical competence.

The interview revealed that even though subcontractors are not part of the alliance commercially and specifically do not benefit from the gain:pain mechanism, but in every other way the alliance team treated subcontractors as part of the alliance. In order to ensure project performance, the alliance offered extensive technical training to their subcontractors. All subcontractors are invited to the weekly toolbox meeting called 'one team session' and

project celebrations. The IT2 strongly agreed ‘commitment of all participants’ is a critical element to successful alliancing. However there is a difference in individual standards of commitments and ‘one team’ sessions can be used to cultivate the conditions for realising the participants’ full commitments. This session creates a forum to explain the current picture of the project to the wider project teams and the mutual exchange of ideas initiated by this process leads to commitment in achieving project goals.

IT1 was asked to comment on current subcontractor management practices, for example, performance evaluation, early stage involvement, communication systems, and rewarding mechanism for process improvements. IT1 responses revealed that some aspects of lean supply principles were well adopted by the case study organisation namely long term informal relations with subcontractors, subcontractors within alliance are seen as one group and usage of group-based development tools especially ‘one team’ sessions. Even though, the innovativeness of subcontractors was not sufficiently exploited. There is evidence of interactions with subcontractors at an operational level (such as weekly toolbox meetings) but subcontractors’ management level representation in that meeting is minimal and they were not involved in earlier stages of the alliance.

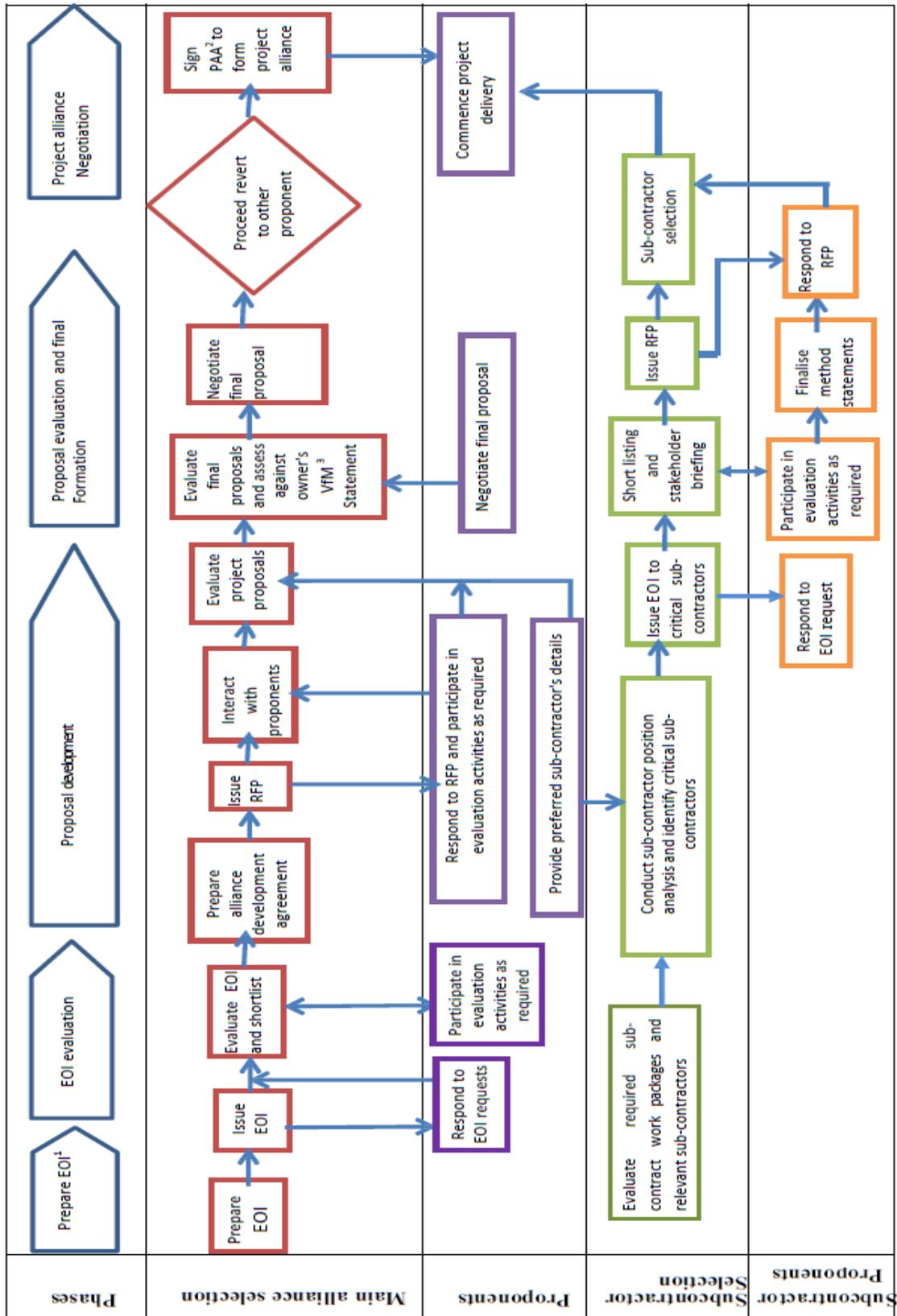
The three interviewees indicated that the alliance provides assistance to subcontractors’ and suppliers’ business development through sharing knowledge and providing necessary training. This inter-organisational involvement is evident in this particular alliance project but without any commercial benefits such as a sub-alliance agreements for the subcontractor. This is a challenge to the alliance contract type which IT2 alluded to as follows:

*A Subcontractor is not part of the alliance but they still work for the alliance. A Subcontractor is not directly employed by any of the participants. A key senior staff member is appointed directly by the one of the participants to provide the management and leadership to the subcontractor. However, a subcontractor does a large proportion of the actual project work at the site but still it is not part of the alliance. This is a challenge.*

The following section presents a framework that attempts to integrate subcontractors into the main alliance framework. The suggested framework was developed on the premise that critical project participants are able to form symbiotic working relationships (Maturana, Alarcón, Gazmuri, & Vrsalovic, 2007) from the early phase of an alliance project.

## **A FRAMEWORK FOR IMPROVED SUBCONTRACTOR INTEGRATION**

Following the objective of the study, which is to reorganise subcontractor involvement in alliances, this section describes the framework that is suggested to achieve this objective. The current state of most alliance projects could generate significant inefficiencies because of the lack of integration of key domestic subcontractors into the alliance framework. Figure 3 shows a process flowchart that integrates subcontractors with a main alliance team.



EOI—expression of interest, <sup>2</sup> PAA- Project alliance agreement, <sup>3</sup> VFM- Value for money

Figure 3: Selection process of alliance participants including subcontractors

Source: Adapted from Commonwealth of Australia (2011); Vilasini, Neitzert, Rotimi, & Windapo (2012)

The flowchart is an adaptation of the process flowchart for alliance contracting published by the Department of Infrastructure and Transport, Australia (Commonwealth of Australia, 2011). The suggested sub-alliance enters the alliance environment during the pre-project planning phase and carries on through project execution till the post project review phase. The following paragraphs explain the implementation steps a framework that will permit subcontractor integration into the main alliance.

In order to identify potential subcontractors, main alliance members would be required to nominate subcontractors (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. Main contractors would collate request for proposals (RFPs) from their subcontractors and thence provide a manageable list of existing subcontractors for further investigation.

After all proposals have been submitted, potential main alliance and sub-alliance participants are identified based on 'capacity analysis' of the main alliance participants. Roles are not restrictively defined, but allocated on a 'best person' basis. 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. 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 subcontractor competence matrix. The main alliance proponent selection workshop could be used to develop a standard for subcontractor evaluation and selection. Non-price parameters such as technical and managerial competence, past cognate experiences, innovation, and financial viability of these organisations could be determined and weighted at this stage. This is the subcontractor evaluation matrix which could improve transparency and eliminates the negative effects of price competition. Project-specific factors, subcontractor evaluation criteria along with the qualifications of subcontractors are considered and a shortlist is drawn of potential subcontractors suited for the project.

At the commercial alignment phase of the main alliance, the alliance members would need to develop a reward formula for subcontractors which aligns with the main alliance key performance indicator (KPI) system. This reward formula could be negotiated with the subcontractors 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. Shortlisted subcontractors 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 subcontractors, who may be required to indicate their strategic objectives for participating in the project. Subsequently all shortlisted subcontractors 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 of the sub-alliance teams. Their early involvement should build trust, strong relationships and commitment throughout the value chain. This will probably results in fewer requests for

information during the construction stage because subcontractors have been involved in design development and method study preparation works.

Later the alliance proponent members would evaluate all proposals. The list of subcontractors 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 teams are listed and they are assigned roles depending on their relevant skills. A further selection procedure may involve workshops to reconcile the various subcontractor priorities and feedbacks. Provisional agreements are prepared using the strategic objectives of each participant and distributed amongst 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 could be helpful to organize a session with unsuccessful applicants to explain why they were unsuccessful. Alliance board members may conduct this session in the presence of the project owner.

After the selection of subcontractors, all alliance and sub-alliance members are invited to the sub-alliance initial 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 a '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 unhindered. The final agenda item is the signing of the sub-alliance agreements by relevant parties.

Some of the potential benefits that an alliance could gain from the sub-alliances are to share any favourable cost variations resulting from efficiencies and an alignment of goals for the construction team rather than having main alliance and subcontractors pursuing separate agendas.

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 potential mitigating issues. Inter-company training events should be conducted during project execution to exchange best practices and collective commitment towards project execution.

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 subcontractor could assess their performance and could use the 'expressions' evaluation system that has three mood states in different colours 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 any training development plan.

Immediately after any feedback, sub-alliance team members would be required to share information, discuss project plans, and generate ideas. Consecutively, relationship status monitoring could be on-going to assess alliance participants as perceived by other participants. An alliance participant's score questionnaire could be distributed at monthly sub-

alliance meetings where performance scores are assigned to other members and changes in the score can be openly discussed. Depending on performances, training programmes are developed having a technical or managerial scope to improve performance. For technical issues, continuous improvement meetings may be conducted among participants to analyse issues. New suggestions may be introduced and the best alternative implemented. This should be the main agenda at monthly sub-alliance meetings. 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 other strategic objectives that were agreed upon at the beginning of the project. At this meeting, the participants should actively discuss the opportunities for future alliances. At the project completion stage, alliances should consolidate previous periodic evaluations and lessons learned in a central database for future alliance projects.

### Applicability of the recommended framework

The flowchart developed for subcontractor integration into an alliance (see figure 3) describes the manner through which subcontractors' could be introduced and managed in an alliance efficiently. The framework combines the concerns of nomination, selection, evaluation, performance tracking and project coordination that apply to subcontractors' activities on typical construction projects. The study used inputs from the management staff of the case study organisation for the framework development and addresses issues which could impact on the successful implementation of the framework. A key management staff (IT1) commented thus:

*There are many things which we have learned in this project. If we moved to another alliance, these lessons would be applied immediately. Especially the involvement of the subcontractor in early stages and subcontractor manager involvement in the "one team session" would be beneficial.*

Thus it is envisaged that the framework portends benefits, from an expanded alliance team, as project participants to get to know each other and form mutually agreed goals. By bringing in specialist/critical subcontractors into the alliance project team (rather than working through several layers of contract procedures) a more direct communication with the main alliance management could be obtained.

Alliancing focuses on establishing a strong project execution team that is extremely important to projects success, but it is equally important to create strong working relationships with subcontractors. For a project to be successful, the alliance team must ensure that its subcontractors are committed and dedicated to the project and the alliance form of procurement. IT1 alluded to the importance of subcontractor integration thus:

*If the sub-contract is on a fixed price, they might not always want to devote the time and energy into thinking about innovation. They always want to get the job done. Another option could be offering a percentage of final savings for subcontractors' suggestions. This option is very valid but it just needs to be managed very well before applying*

Therefore in order to ensure a strong alliance team this framework suggests a subcontractor-specific evaluation system and a process improvement suggestion system for subcontractors.

The implementation of progressive inspections of subcontractors' work, rather than final inspections is thus facilitated. Such practice will enable more cost effective operations and early solution of problems that could arise during project execution. Early attention to rectifications of defective work is to the benefit of all parties.

It is apparent that subcontractors can and should play a significant role in pursuit of project performance improvement. However a major barrier to such a role expansion is that subcontractors often do not have the management structure and skills to be able to fully engage. A key alliance board member (IT3) suggests that the alliance would probably need a dedicated person to manage these sub-alliances and to provide training to management staff of minor subcontractors.

## CONCLUSION

Alliance procurement was developed to remove common project administration issues in traditional procurement methods by encouraging maximum the contribution of every project participant to achieve successful outcomes. However it is common to leave out subcontractors from the main alliance even though a major portion of physical execution is undertaken by them. Given the significance of sub-contracting within an alliance project, future performance improvement requires an acceptance of the benefits of role expansion of subcontractors who carry out the actual construction work. This paper presents the findings of a research project that examined alliance participants' perspectives on subcontractor integration in an alliance. The case study project investigated found that certain improvement opportunities existed in subcontractor management practices within alliance projects. The authors suggest that an extension of alliances to include some critical subcontractors would augur well for alliance projects. The suggested framework promotes the selection and formation of sub-alliance teams using similar criteria to those of core alliances. Such criteria are usually non-price based, but based on criteria like innovativeness, ability to collaborate and the alignment of strategic objectives with KPIs identified for any 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. The authors hope that the opportunity created by early involvement of key subcontractors will enhance overall alliance project objectives. It is imperative that the expertise of these key participants (subcontractors) be integrated into the main alliance to ensure commitment throughout the project value chain. This paper proposes a framework which allows the establishment of a sub-alliance team in tandem with the objectives of core alliances. This has the potential to facilitate further improvements in the efficacy of project delivery processes. A range of attitudinal change requirements for integrating smaller companies into the drive for continuous improvements are identified. It is hoped that leading clients would take responsibility for engendering this culture change throughout their supply networks, if further performance improvement is to be realised within the construction industry.

## ACKNOWLEDGEMENT

The authors are grateful to New Zealand Transport Authority (NZTA) and the Northern Gateway Alliance (NGA) for granting permission to publish this paper.

## REFERENCES

- Ahuja, H. N., Dozzi, S. P., and Abourizk, S. M. (1994). *Project management: techniques in planning and controlling construction projects*. NY: Wiley.
- Alarcón, L. F., Diethelm, S., Rojo, O., and Calderon, R. (2005). Assessing the impacts of implementing lean construction *International Group for Lean Construction*. Symposium conducted at the meeting of the International Group for Lean Construction, (IGLC)-13, Sydney, Australia,.
- Andreas, H., Florence, Y. Y. L., and Jane, S. H. T. (2009). Relative Importance of Subcontractor Selection Criteria: Evidence from Singapore. *Journal of Construction Engineering and Management*, 135(9), 826-832.
- Brown, D. C., Ashleigh, M. J., Riley, M. J., and Shaw, R. D. (2001). New project procurement process. *Journal of Management in Engineering*, 17(4), 192-201.
- Commonwealth of Australia. (2011). *National Alliance Contracting Guidelines: Guide to Alliance Contracting (INFRA /1148)*. Canberra, Australia: Department of Infrastructure and Transport Retrieved from [www.infrastructure.gov.au/infrastructure/nacg/files/National\\_Guide\\_to\\_AllianceContracting04July.pdf](http://www.infrastructure.gov.au/infrastructure/nacg/files/National_Guide_to_AllianceContracting04July.pdf)
- 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(1), 15-23.
- Davies, J. P. (2008). *Alliance Contracts & Public Sector Governance* (Doctoral thesis). Griffith University, Queensland. Retrieved from <http://www4.gu.edu.au:8080/>.
- Eriksson, P. E., and Westerberg, M. (2011). Effects of cooperative procurement procedures on construction project performance: A conceptual framework. *International Journal of Project Management*, 29(2), 197-208.
- Francis, V., and Hoban, A. (2002). Improving contractor/subcontractor relationships through innovative contracting *CRC Press*. Symposium conducted at the meeting of the 10th Symposium Construction Innovation and Global Competitiveness Retrieved from <http://dx.doi.org/10.1201/9781420040104.ch58>
- Gadde, L. E., and Dubois, A. (2010). Partnering in the construction industry--Problems and opportunities. *Journal of Purchasing and Supply Management*. doi:10.1016/j.pursup.2010.09.002.
- Huang, R. Y., Huang, C. T., Lin, H., and Ku, W. H. (2008). Factor analysis of interface problems among construction parties—a case study of MRT. *Journal of Marine Science and Technology*, 16(1), 52-63. Retrieved from <http://jmst.ntou.edu.tw/marine/16-1/52-63.pdf>.
- Hughes, W., Hillebrandt, P., and 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., and Kumaraswamy, M. (2003). Pre-construction project partnering: from adversarial to collaborative relationships. *Supply Chain Management: An International Journal*, 8(2), 166-178.
- Kwok, T. L., and Hampson, K. D. (1997, July 14-15). Strategic Alliances Between Contractors and Subcontractors—A Tender Evaluation Criterion for the Public Work Sectors Symposium conducted at the meeting of the Construction process re-engineering : proceedings of the International Conference on Construction Process Re-engineerin, Gold Coast, Australia.
- Latham, M. (1994). Constructing the Team (the Latham Report). *Industry Review of Procurement and Contractual Arrangements In The UK Construction Industry HMSO, London*.

- Lehtinen, U. (2001). *Changing Subcontracting: A study on the evolution of supply chains and subcontractors* (Academic Dissertation). University of Oulu.
- Lehtonen, W. T. (Ed.). (1998). *Improving sub-contacting of the construction industry by participatory cooperation* (Human factors in organizational design and management ed.). Oxford, UK: Elsevier science.
- Masrom, N., and Asrul, M. (2007). *Nature of delay in nominated subcontracting* (Master thesis). Universiti Teknologi Malaysia, Faculty of Built Environment. Retrieved from <http://eprints.utm.my/4439/>.
- Maturana, S., Alarcón, L. F., Gazmuri, P., and Vrsalovic, M. (2007). On-site subcontractor evaluation method based on lean principles and partnering practices. *Journal of Management in Engineering*, 23(2), 67.
- Miles, R. S. (1998). Alliance Lean Design/Construction on a small high tech project Symposium conducted at the meeting of the International Group for Lean Construction (IGLC-6), Guaruja, Brazil.
- Morwood, R., Scott, D., and Pitcher, I. (2008). *Allowancing a participant's guide* Queensland, Australia.: Maunsell AECOM.
- Ohnuma, D. K., Pereira, S. R., and Cardoso, F. F. (2000, April 24 – 27). The Role of the Subcontractors in the Competitiveness of Building Companies and the Integration of Value Chains Symposium conducted at the meeting of the Proceedings of the CIB W92 Procurement System Symposium, Santiago, Chile.
- Ramus, J., Birchall, S., and Griffiths, P. (2006). *Contract practice for surveyors*. Heinemann, London.: Butterworth-Heinemann.
- Ross, J. (2003, March 23, 2010). Introduction to Project Allowancing- On engineering and construction projects Symposium conducted at the meeting of the Allowancing contract conference, Sydney, Australia.
- Tam, V. W. Y., Shen, L. Y., and Tam, C. M. (2007). Assessing the levels of material wastage affected by sub-contracting relationships and projects types with their correlations. *Building and Environment*, 42(3), 1471-1477.
- Tang, W., Duffield, C. F., and Young, D. M. (2006). Partnering mechanism in construction: An empirical study on the chinese construction industry. *Journal of Construction Engineering and Management*, 132(3), 217-229.
- Usdiken, Z. S. B. (1988). Strategies and boundaries: subcontracting in construction. *Strategic Management Journal*, 9(6), 633-637.
- Vilasini, N., Neitzert, T. R., Rotimi, J. O., and Windapo, O. A. (2012, 23rd - 25th January). Reorganization of sub-contractor management practices in alliance contracts Symposium conducted at the meeting of the CIB W070, W092 and TG72 International Conference on Facility Management, Procurement Systems and Public Private Partnership, Cape town, South Africa.
- Wood, G. D., and Ellis, R. C. T. (2005). Main contractor experiences of partnering relationships on UK construction projects. *Construction Management and Economics*, 23(3), 317-325.
- Yin, H., Wang, Z., Yu, J., Ji, Z., and Ni, H. (2009, May 23-24). Application of DEA Cross-evaluation Model in Project Dynamic Alliance Subcontractors Selection Symposium conducted at the meeting of the IEEE conference in Intelligent Systems and Applications (ISA) Wuhan, China. Retrieved from <http://ieeexplore.ieee.org>