Revised March 2009
Accepted March 2009

A project management prospective in achieving a sustainable supply chain for timber procurement in Banda Aceh, Indonesia

Kelvin Zuo, Regan Potangaroa, Suzanne Wilkinson and James O.B. Rotimi
(Information on the authors can be found at the end of the paper.)

Abstract

Purpose – The purpose of this paper is to explore the alternative procurement procedures that will address the complexity of issues surrounding timber procurement for housing reconstruction after the Tsunami in Banda Aceh. It reviews construction supply chain management (SCM) and procurement philosophies with a project management (PM) perspective to facilitate the logistics of post-disaster reconstruction.

Design/methodology/approach – Based on two fieldtrip experiences in Banda Aceh in 2006 (one month) and 2008 (two months) with the housing reconstruction program of an international non-governmental organisation, this paper examines the modern literature on SCM and analyses this process associated with construction material procurement in practice, reviews the problems inherited in the Indonesian context and analyses the proposed procedures of local and international procurement of timber to streamline the supply for reconstruction in Banda Aceh, Indonesia.

Findings – The incorporation of sustainable considerations into the design of procurement routes in the overall PM process for post-disaster construction should be well recognized. The paper shows that basic SCM philosophies of ensuring stakeholder integration and collaboration could reduce the problems in timber procurement in Banda Aceh. Sustainable construction and triple bottom lines criteria are proposed to ensure a value creation process for a wider stakeholder engagement and overall reconstruction project delivery.

Originality/value – The paper provides useful PM insights into SCM and sustainable construction literature. The case study reviews the timber procurement problems and goes further to present two alternative procurement models that could be implemented as more sustainable responses to post-disaster reconstruction in Banda Aceh.

Keywords Supply chain management, Sustainable development, Procurement, Project management, Natural disasters, Indonesia

Paper type Research paper

Introduction

Banda Aceh in Indonesia was one of the worst hit areas during the Boxing Day Tsunami in 2004. About 130,000 lives were lost and a further 37,000 unaccounted for. In March 2005, another 1,300 was added to the death toll in Nias, Simeulue and the

Note this paper was originally delivered at the Building Abroad – Procurement of Construction and Reconstruction Projects in the International Context Conference held at Université de Montréal October 23-25, 2008. Papers were double blind reviewed and subsequently amended and expanded to reflect the project management perspective and furthered reviewed.

International Journal of Managing Projects in Business
Vol. 2 No. 3, 2009
pp. 386-400

1753-8378
DOI 10.1108/17538370910971045

Southern Coastline of Aceh. This cycle of natural disasters have left families homeless and caused untold hardship across the region. It is estimated officially (Badan Rehabilitasi dan Rekonstruksi – BRR, 2006a, b) that about 123,000 new houses were required to re-establish, relocate and resettle victims of the Tsunami together with the need to provide supportive social and infrastructural facilities.

Many non-governmental organisations (NGOs) were involved in reconstruction projects around Aceh. These projects were scattered across the breadth of the disaster affected area with the consequence of a spike in construction materials requirement. Timber procurement was a source of frustration. The supply of timber was fraught with delivery delays and quality issues. There were other logistical and legitimate issues that had to be addressed, which in turn influenced the decision making on the selection of alternative procurement sources and procurement processes. These complexities of issues are common to post-disaster reconstruction which is characterised by chaos and often reconstruction objectives and priorities remain unmet.

This paper presents the result of an investigative study of timber procurement in Banda Aceh for reconstruction. The objective of the study was to determine the causes of the timber procurement problems and to explore possible remedies, so that future reconstruction programmes can be facilitated more quickly than occurred in Banda Aceh. The paper examines the adoption of sustainable practices at all stages of the supply chain as part of a boarder consideration of stakeholder engagement and sustaining local economies using triple bottom line (3BL) concepts, as well as the implications of such practices in post disaster-reconstruction.

The main theme of project management (PM) in a sustainable construction environment is the shift from product creation to value creation. Winter *et al.* (2006) puts it more succinctly that the main concern for many organisations:

> [. . .] is no longer the capital asset, system or facility, etc. but linking business strategy to projects, maximising revenue generation, and managing the delivery of benefits in relation to different stakeholder groups.

This has practical implications to the recovery programme in Banda Aceh. All the organisations involved in the reconstruction projects need to focus on the value added by each individual project to different stakeholders rather than competing for limited resources and compromising the overall value created in the recovery process.

First, the paper reviews the literature on supply chain management (SCM) and sustainable construction philosophies which it believes need to be understood by the Aceh's reconstruction stakeholders. Some of the concepts reviewed include communication needs, supplier base reduction and long-term relationships, supplier and logistics integration in SCM, relationship management in sustainable construction, and the notion of economic growth with an emphasis on social and environmental integrity, the 3BL concept. Following this is a presentation of the findings and result obtained through the investigative study of timber procurement in Banda Aceh. Two alternative process models for timber procurement are identified and analysed. The paper then concludes with the discussions and subsequent recommendations and suggestions on how basic SCM philosophies of ensuring stakeholder integration and collaboration could reduce the problems in timber procurement in Banda Aceh.

An overview of SCM

In order to accommodate the growing complexity of construction process, various management systems and methods have been developed in academic researches and well applied in industry practices. Among those, SCM becomes increasingly popular, especially within the context of broader cooperation, vertical disintegration and the viewpoint of a networked supply chain in the construction industry. Its popularity has been stimulated by a range of sources including the quality revolution (Dale *et al.*, 1994), notions of materials management and integrated logistics (Carter and Price, 1993), a growing interest in industrial markets and networks (Ford, 1990; Jarillo, 1993), and influential industry-specific studies (Womack *et al.*, 1991; Lamming, 1993). "Supply chains," "demand pipelines," "value streams," "support chains" are some examples of the terms used to describe this process.

A predominant approach to SCM research is the so-called "supply management," which emphasizes primarily the buyer-supplier relationship (Leenders *et al.*, 2002) within the process. Since suppliers have a profound and direct impact on cost, quality, time and responsiveness of the buying firms, the management of relationships with other members of the supply chain (i.e. buyer-suppler relationship) is increasingly being referred to as SCM (Chen and Paulraj, 2004). The literature on SCM has constantly emphasized the importance of effective two-way communication to the above relationship. Carr and Pearson (1999) argue that in order to jointly find solutions to material problems and design issues, buyers and suppliers must commit a greater amount of information and be willing to share sensitive design information. However, this is often achieved through engineer-to-engineer communication on design issues keeping in mind improved process capability, manufacturability, and performance without affecting profit margins (Bhote, 1987; Dobler *et al.*, 1990; Turnbull *et al.*, 1992). Poor communication was often a fundamental weakness in the interface between a buying firm and its supplier, it undermined the buying firm's efforts to achieve increased levels of supplier performance (Lascelles and Dale, 1989). This is a major problem experienced by various agencies involved in the Aceh reconstruction and embodied in competition for resources and increased difficulty in construction materials procurement.

Traditional practices of SCM tend to contract with multiple suppliers even for the same material or component. This is partially due to the consideration of risk reduction with multiple options and avoidance of becoming source dependent. However, reduction of the supplier base is a unique characteristic of contemporary buyer-supplier relationships (Newman, 1988; Helper, 1991), because the administrative or transaction costs associated with managing a large number of vendors often outweigh the benefits (Dyer, 2000). This is especially the case in the Aceh reconstruction given the limited availability of construction materials and often inadequate administrative ability of reconstruction agencies. Many firms are reducing the number of primary suppliers and allocating a majority of the purchased material requirements to a single source (Pilling and Zhang, 1992; Kekre *et al.*, 1995). The benefits attributed to this practice often exceed those achieved through traditional bidding from multiple sources, which often emphasizes low price at the expense of performance (Mohr and Spekman, 1994). Moreover, supply base consolidation sets the stage for future development of the chosen suppliers (Handfield, 1993).

Long-term relationships between supplier and buyer have become a crucial characteristic of modern supply chain relationships (Shin *et al.*, 2000). Through close relationships, supply chain partners are willing to share risks and reward and maintain the relationship over a longer period of time (Cooper and Ellram, 1993; Stuart, 1993). Hahn *et al.* (1983) compared the potential costs associated with different sourcing strategies and suggested that companies would gain benefits by placing a larger volume of order with fewer suppliers using long-term contracts. Moreover, through a long-term relationship, the supplier will become part of a well-managed chain and will have a lasting effect on the competitiveness of the entire supply chain (Choi and Hartley, 1996; Kotabe *et al.*, 2003). A well-coordinated joint order of similar construction materials by several NGOs would be a good example of sustainable management of such practice.

A recent trend of supplier certification provides a potential solution to the procurement problems relating to the selection of tenders. It involves, the thorough examination of all aspects of a vendor's performance and is expected to enhance buyer-supplier trust and communication, to improve supplier product quality, to reduce communication errors and to reduce inspection and inventory costs for the buyer (Schneider *et al.*, 1995; Larson and Kulchitsky, 1998; Ittner *et al.*, 1999). Recently, supplier certification has been extended to include the logistics function. American Quality Foundation and Ernst and Young (1993), in their international quality study of over 500 organizations, reported that formal programs for certifying suppliers showed an across-the-board beneficial impact on performance, especially in quality and productivity.

Sustainable construction and 3BL in project procurement

As discussed above, SCM has long been considered an important strategy for public sector governance. It has, however, proven difficult for all governments, globally, to implement (Burnes and Coram, 1999). Research shows that relationship management brings about more harmonious working relationships (Cheung *et al.*, 2006). Relationship management is a sustainable approach to the industry in terms of social, environment and economics sustainability, as well as helping to satisfy client and stakeholder interests (Darwin *et al.*, 2000; MacNeil, 1978; Rousseau and Parks, 1993). Clients and contractors can potentially make savings in their operations under a relationship management regime through sharing and exchanging technical and managerial knowledge of the project.

The quest for sustainability has put the construction industry under immense pressure from the government and general public to improve its unsustainable pattern of project delivery. Sustainable development was popularised and defined by Brundtland (1987) as "development that meets the needs of the present without compromising the ability of the future generation to meet their own needs." Analysis of the construction industry's project delivery process substantiates the need for the industry to engage with sustainable development (BRE, 2000).

The implementation of sustainable development in the construction industry could be referred to as "sustainable construction." Sustainable construction comprises many processes through which a profitable and competitive industry delivers built assets to enhance quality of life and stakeholder satisfaction (Department of the Environment, Transport and the Regions, 2000). Embedded in this definition is the notion of economic

growth with an emphasis on social and environmental integrity. The environmental, social and economic impacts of the construction industry are extensive, often irreversible, readily identifiable, and sufficiently documented (Ofori, 1992; Griffith, 1994; Chen and Chambers, 1999). Recent research has shown that it is becoming more apparent to the industry that the sustainability agenda falls beyond environmental protection but also includes social and economic objectives (CRISP, 1999).

The 3BL concept came to the forefront of PM thinking with Elkington (1997) arguing that organisations should report performance in more than purely financial terms because this does not fully adequately address the value proposition of significant stakeholders. The second two "bottom lines" are social and environmental. Because the businesses in general is to serve society by delivering goods and services, and the environment also sustains business activity, so any activity that harms the social and environmental bottom lines can potentially harm existing and future markets (Walker *et al.*, 2008). This could be seen as an extension on the concept of social and environmental integrity associated with economic growth in sustainable construction. Increasingly, sustainability in 3BL is becoming a major part of project procurement criteria, which is a crucial factor to be considered among engaging stakeholders, especially in post-disaster reconstructions, such as in the following case study.

Research approach

The basic premise underpinning the study was to determine the applicability of construction SCM and procurement philosophies to facilitate the logistics of timber procurement in Banda Aceh. Therefore, management concepts such as communication needs, supplier base reduction, supplier and logistics integration, long-term relationship management and sustainable practices are explored as possible solution to the timber procurement problems.

Two authors of this paper spent a one-month fieldtrip in Banda Aceh, two years after the Tsunami. They then followed this up one year later with another two-month fieldtrip. The study involved working with the Indonesian branch of an international humanitarian aid organisation involved in the house reconstruction project for local refugees. During these trips, extensive interviews were carried out with construction and procurement managers of different NGO's, United Nation agencies and their local staff, representatives of local authorities overseeing the reconstruction process and members of the Village Development Committee and affected communities in Aceh.

Major obstacles associated with construction materials procurement were identified during the interviews. Two procurement methods representing local and international supply chains for timber were selected out for detailed analysis. Data collected and ideas generated from this series of interviews and pilot case studies were incorporated and expressed in the discussions within the following sections. Several recommendations are made in the conclusion to tackle the problems encountered as a way of streamlining the timber supply chain and the overall reconstruction programme.

The timber procurement problem in Banda Aceh

Although costal areas were seriously damaged during the 2004 Tsunami, 70 percent of mainland Aceh is still covered by natural tropical forests: the best remaining tropical forests in Indonesia and rich in biodiversity. One can see the beautiful green land under the plane when flying over the Sumatra Island. It is the natural gift inherited by

generations of Indonesian people but now is forced "open for exploitation" (*Indonesia-Relief News*). In spite of a moratorium on logging in Aceh, implemented pre-Tsunami, extensive illegal logging is currently taking place in Aceh forests. This is usually referred in relation to a so-called "Timber Mafia" situation: a term used to describe a consortium of government officials, army, police, businessmen, etc. who allegedly conspire together to gain large profits from the illegal logging of the forest estate. Problems in getting a legal and sustainable timber supply for reconstruction are a frustrating experience for almost every reconstruction agency and this situation could continue for longer.

The Government of Aceh (represented by BRR[1] regarding reconstruction) reviewed its timber policy in light of the tsunami and the need for timber for recovery. The acting governor is in favour of a "Green Aceh," with no logging and supports World Wildlife Fund and other conservation NGOs' programmes promoting the use of imported timber from sustainably managed forests for reconstruction. These are also supported by the Ministry of the Environment in Indonesia. On the other hand, the Government of Aceh realizes the tremendous need for legal timber supply within the area. At the end of 2005, Indonesian Ministry of Forestry decided to restore forest concession (HPH) to 11 companies in Aceh to enable them to supply timber needed for the Aceh reconstruction and agreed to increase timber quota for Aceh to 400,000 m^3 for 2006. This decision had to be made since timber suppliers from other provinces, such as Riau and Kalimantan, are reluctant to cater for the needs in Aceh due to a high cost of transportation and the complicated process of applying for legal documents to facilitate transportation.

It is estimated in a survey conducted by BRR and The World Bank (2006) that the bribes and illegal payments that truck drivers pay on the Banda Aceh – Medan road with corrupt police, military, state officials, and preman (criminal) groups at various security posts and weigh stations are Rp. 340,000 on average (approximate US$36 according to the 2006 exchange rate, single trip in either direction). This not only constitutes an additional cost for timber transportation but also has negative influences to potential timber dealers from outside provinces. However, the number of illegal payments experienced a significant decline with the pull-out of troops and police from the Aceh Province mandated by the Helsinki peace agreement.

There are other specific problems in timber procurement in Aceh, such as the legitimacy of importing timber and associated timber treatment methods. It is partially due to confused and sometimes conflicting information from different government sources, which could only be explained as internal uncertainty and inconsistency with Indonesian timber policies or failure in execution of established standard regulations. A list of 25 local timber supplier companies approved by BRR was given to representatives from various NGO's during a BRR's timber policy meeting in July 2006, which, several days later was reduced to a list of five and handed out to local project managers during another local staff meeting. These were only recommended as reliable and not guaranteed as legal. The responsibility of ensuring the legality of procurement with those companies remains on NGOs' shoulders. It is almost impossible for any organisation to take on such a big risk (even one piece of illegal timber will result in the whole package being confiscated) and be able to continue operating.

Feasible timber procurement procedures

In spite of these difficulties, timber for Aceh reconstruction is still procured legally and sustainably, or at least non-illegally and non-unsustainably, from some sources to some organisations. All of them can be categorized either as locally supplied or internationally imported/donated. The procedure followed in each will be introduced and generally reviewed.

International timber procurement

A sequential steps of international timber procurement procedure has been identified as shown in Table I, based on an introductory paper of suggested purchase flow prepared by Douglass (2006) from British Red Cross.

Imported timber from New Zealand or Canada using the above procedures has usually been treated as a Hazard Class H3.1 standard for an above ground application. The specific treatment method is Light Organic Solvent Preservative rather than[2] Chromium-Copper-Boron and Chromium-Copper-Fluorine (CCB/CCF) used in Indonesia. The prices range from US$420 to 590/$m^3$ cartage, insurance and freight at Medan depending on required grade, treatment and processing options, while local timber prices are usually within US$350-550/$m^3$ from legal sources. Although the price of imported timber is understandably higher than the local supplies, there are several advantages of importing timber for the Aceh reconstruction.

The first advantage is the longer and guaranteed durability, protection from weather changes and protection from insects and fungi attack under Indonesian conditions. It has an internationally recognized guarantee of sustainable management and production of timber as well as with other internationally recognized third party

1	Prepare house design and detailed bill of quantities
2	Prepare purchase documents: (a) request for quotation, (b) technical specification schedule, (c) proforma invoice
3	Send above documents to potential suppliers and invite to bid
4	Submission of bids and tenders evaluation
5	Notify successful tenderer and confirm intent by issuing a purchase order
6	Successful tenderer accepts the offer and submits a proforma invoice (2c), thus a contract relationship is formed
7	The irrevocable letter of credit (ILC)[a] prepared by purchaser's bank accepted and confirmed by supplier's bank using the information in proforma invoice (2c)
8	Production initiated
9	Shipping schedule organised and notified to the purchaser by the supplier
10	Shipping documents[b] sent to the purchaser by the supplier on port of departure
11	Purchaser applies to the BRR for tax free gift status on the basis of being a registered tsunami reconstruction programme in Aceh
12	ILC payment and documents exchanges occur
13	Purchaser or its shipping agent arranges customs pre-clearance, phytosanitary, etc. using the shipping documents and support letter from BRR
14	Following logistics from ship at arrival port (Belawan, Medan) to final destination

Notes: [a]The basis and payment terms of international timber trade, almost no suppliers will start purchasing logs or initiating production without a satisfactory ILC confirmed by their bank first; [b]including documents of clearance of goods through customs and quarantine requires: (1) invoice, (2) packing list, (3) phytosanitary certificate from port of loading, (4) air bill or bill of lading (B/L) as a substitute for other documents but only possible for a temporary period

Table I.
International timber procurement procedure for Aceh reconstruction

certification and audit of treatment standards, certificate of origin and chain of custody. Another advantage is the large amount available (30,000-40,000 m^3/month if long-term orders are placed) while uncommitted local supply is limited to approximate 1/10 of that from international sources. The supply chain is simplified and bureaucratic process of applying SKSHH[3] and other legal documents from the Government of Aceh could be avoided. Most importantly, for every log sourced internationally for use in Aceh, one tree from local tropical forests could been saved.

However, some disadvantages are obvious and make this option less attractive when decisions are made at an individual organisational level. Besides, the higher prices, the longer delivery schedules (at least 4-6 weeks, but generally believed as ten weeks) often excludes it as an option. The required amount of timber is limited at each time of procurement, thus, the large availability of international sources is no longer an advantage. This is partially due to the lack of overall SCM and communications between procurement and project teams. A large order of timber could be streamlined and procured at a lower price, rather than subdivided into small packages with only several hundred cubic meters each and procured once in a while, however this creates a longer and complicated timeline. Storage of a large amount of international timber is another problem because of the associated demurrage charges that are extremely expensive if the shipment has to be left at the port. Timber is a natural product that must be kept dry and out of direct sunshine if possible. Thus, warehousing facilities are essential in the logistics of transporting timber from port to construction site while, local timber could be delivered to the site at vendor's expenses as required each time. The uncertainty of legitimacies within the Indonesian context related to imported timber together with issues related to donation and standard treatments required, further contribute to the unpopularity of international timber procurement in Aceh.

Local timber procurement

Similarly, in order to understand the local timber procurement procedure, a flowchart developed and handed out as a suggested guideline by BRR is shown in Figure 1.

Although aiming at providing recommendations for timber transportation, this flowchart could also be used as a guideline for local timber procurement and associated logistics. There are some terms used only in Indonesian timber industry that are worth explaining. The big circle in the flowchart represents Timber Helpdesk and Tim Terpadu (Forestry Department) at BRR headquarter: the most important interface to users, suppliers, shipping agencies and other departments in Government of Aceh. Timber Helpdesk was designed by BRR in order to address timber issues for reconstruction and rehabilitation in Aceh and Nias. It has a dual role to facilitate the demand and supply of timber and to monitor the timber used for reconstruction within this region. SKSHH appears many times within the flowchart, as explained in footnotes before, it is a set of documents used to define the legality of timber and it is required when the log is transported from the concession companies to the industry or when semi-wood products are ready to be marketed and transported to their final destination. It is worth noting that SKSHH is not required for imported and donated timber.

A typical procedure for local timber procurement could be categorized in three steps, with different relationships between timber user/purchaser and other involved parties, shown in Figure 2.

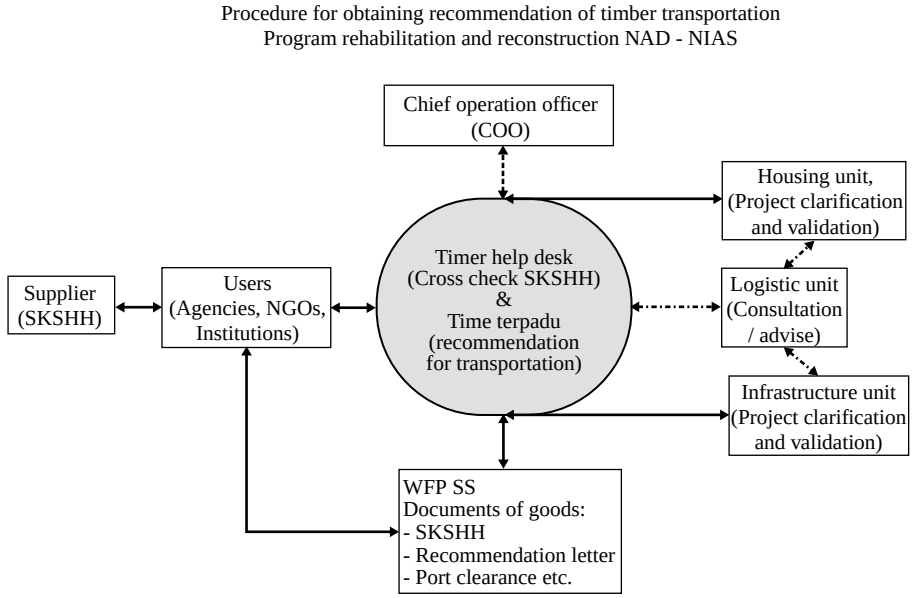

Figure 1.
Local timber procurement suggested procedure from BRR

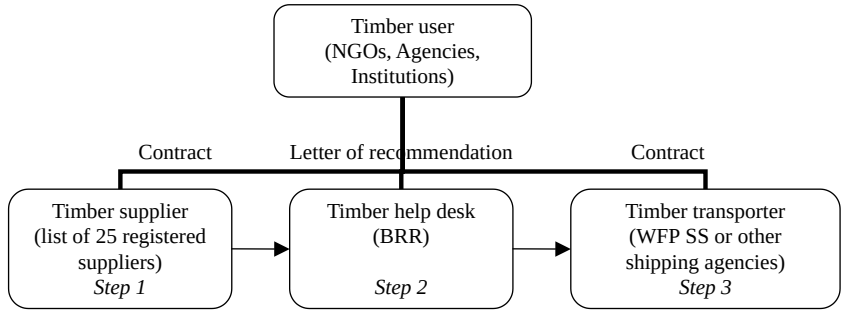

Figure 2.
Typical procurement procedure for local timber supply

As can be seen from above table, in order to procure local timber, the user has to contact a potential supplier based on the names registered with BRR in Step 1. Then the classic tendering process needs to be completed within this step and an agreement or formal contract needs to be entered into with the preferred supplier. After this, the user moves to Step 2 and submits a request to Timber Help Desk in BRR for a letter of recommendation to purchase timber. In order to process this request, BRR has to check with its Housing Unit and/or Infrastructure Unit for the project clarification and validation to make sure that the user is permitted to order timber and that the amount and type of timber requested is in accordance with their needs (Figure 2). Photocopies of the user's Project Concept Note[4] and the contract in previous step are required in order to issue the recommendation letter. Then in Step 3, the user has to provide photocopies of documents gained from Steps 1 and 2 (contract and letter of recommendation) together with an order request to the timber transporter and enter

into another contract for transportation. The transporter recommended by BRR to reconstruction agencies in Banda Aceh is the shipping services provided by World Food Programme.

Overall, it is important that timber users understand the definition of legal timber and the assurance measures in obtaining only legal timber. Legal timber as defined in a BRR (2006a, b) guideline, means that the timber is harvested from legal concessions in accordance with national regulations. Legal concession is a legal timber company that holds a permit for forest utilization from the Ministry of Forestry. The user can purchase timber or timber products directly from merchants, but the responsibility for obtaining legal timber remains that of the user. It is recommended that all the timber bidders for the Aceh reconstruction are required to provide valid forestry permits as well as SKSHH as a pre-qualification for tender.

Review of other options

Alternatives to limited timber supply and other options for sourcing materials for construction are explored and reviewed by organisations involved in the Aceh reconstruction. Those alternative methods and suggestions include using steel trusses (or steel high-pitch roofs) windows, doors and ventilation frames or coconut trees as structural component as replacements to timber products.

The high prices associated with using steel trusses as replacements for timber are the main obstacle. Several factors may contribute to the problem. It is understandable that steel is more expensive than timber but this shortfall could be reduced if less steel is needed for a roof than the amount of timber needed for a timber truss. Actually, a steel high-pitch roof requires much less steel in volume than a traditional timber truss roof. The high price is partially because the mass produced steel roof systems commercially available mainly cater to the needs of factory storage and heavy industry buildings. The pricing of steel roofs for Tsunami relief houses could be significantly reduced if all the reconstruction agencies with the same intention in Aceh organize their individual requests into a bulk order and choose both local and international companies with reliable reputations for a competitive tender for mass production. This is more easily said than done. However, the current coordinating agency BRR has growing power and may be able to do this for its prefabricated houses in the future. Another concern about the use of steel trusses is their acceptance by the community. People are more conservative in remote areas and it is still unclear whether they are willing to move into a "light and shining" steel roof house. This will require a significant amount of on-site community participation and socialization beforehand.

Coconut trees in the form of "palmwood," as another alternative to timber, is a relatively new process but has huge potential to ease the pressure on the world's rainforests, especially in Banda Aceh coastal area, as an ecological substitute to endangered and limited hardwoods. They usually come from farmed plantations of old coconut trees and really are an enormous source of timber that until now have been a wasted by-product from the fruit and food industry. In recent years, people have recognized and explored the potential use of this vast, alternative supply of timber and found that it performs as well as or even better than traditional hardwoods.

Usually, the outer, harder part of coconut trees is used in structural materials for building construction, flooring/decking and furniture design, while its relatively soft inner core is suitable for cladding, screening, and homewares. These could be used as

profitable by-products for the milling workshop owners if mass production of coconut timber for construction is feasible in Aceh in the near future. Another advantage is that the coconut palm is branchless; palmwood is free from knots, which makes it an ideal timber. The issues related to the level of acceptance by the affected community and forestry authority remain. The mass production of coconut timber in Aceh remains a good theory. As more and more research results and real life experiences in favour of this option become available internationally, it is a good opportunity to explore this idea further in Aceh using a government or community-based initiatives to cater the massive needs for timber.

Discussion and conclusion

The incorporation of sustainable considerations into the design of procurement routes for post-disaster construction is well recognised. This starts with the need for more effective and efficient communications along the stream of the overall supply chain and within each and every individual organisation forming this chain. As mentioned earlier in the SCM literature review, buyers and suppliers must commit a greater amount of information and be willing to share sensitive information to achieve increased levels of supplier performance. Good communication is the basis for building a long-term relationship with reliable suppliers. This should be encouraged in order to reduce the supplier base and minimise the administrative or transaction costs associated with managing a large number of vendors. Certain certificates or well-designed criteria for pre-qualification will contribute to the supplier selection process and supplier base consolidation (e.g. require timber bidders for Aceh reconstruction to provide valid forestry permits as well as SKSHH before further consideration of their tenders). Integration, another key principle in contemporary SCM, is suggested in the Aceh reconstruction practices at both supplier and logistic levels.

The design of procurement routes should be put into the broader considerations of sustainable construction environment and 3BLs of financial, social and environmental criteria. As relating to the specific timber procurement process, the procedures of international and local timber supply for reconstruction in Aceh are reviewed in this paper followed by discussions on alternative ways of using steel trusses or coconut timber as solutions to the current problem. It is suggested that reconstruction agencies should seek every possible way of using local timber sources with policy clarifications and transportation suggestions from local reconstruction authority BRR, while exploring the legal, economic and logistic feasibility of imported timber. In order to facilitate the process, it would be better to have an overall procurement plan for the whole project rather than a range of small ones, before starting any negotiation with potential vendors. This should streamline the supply in later stages and result in a better supply arrangement. More studies are required as to the use of coconut timber. It remains an attractive potential for rural areas and isolated islands when policy barriers have been removed. The possibility of milling and use of seized timber or timber from other sources should also be investigated.

The use of familiar and locally available materials for reconstruction should be encouraged. The sustainability dilemma with regards to the use of timber is the balance between the preservation of the environment and the provision of housing. The supply of offshore timber might provide great relief at initial response but in long-term effects, it means that the important economical "kick start" provided by aid in country (and

specifically in Aceh) is lost. The aftermath is people housed in a context of greater poverty. This leads to the need for alternatives such as the use of coconut timber and other possible substitutions for the major uses of timber in house reconstruction.

Recycling certain construction materials from damaged houses remains another possibility. Most steel doors and window frames post-disaster were not seriously damaged and are in large demand. Substitutions could be the use of light gauge steel sections, roofing that can span without the need for timber trusses and different door and window frames. Furthermore, there is also the option to use shorter life span materials for doors and windows with the idea that they would need to be replaced earlier than usual (lowering quality). Although more expensive than timber, steel trusses could be a back up option given the short time and high demand. With a more integrated and sustainable supply chain, prices could be lowered with mass production. This could be made possible through the joint efforts of other reconstruction agencies.

This case study suggests a convergence of SCM and PM into a more reflective form of both. A reflective approach is perhaps at odds with the perception of a rapid, decisive, decision-making project manager in post-disaster reconstruction. Yet the issues addressed in the case study namely:

- stakeholder engagement;
- communication;
- costs and quality;
- procedural identification;
- resource and risk management; and
- ethics

all indicate a solid PM perspective. Moreover, there is also the sense of a greater level of critical reflection over the lessons learnt. The main theme for future development in both SCM and PM as suggested by Winter *et al.* (2006) is in the change from "practitioners as trained technicians" to "practitioners as reflective practitioners." This is indeed important in the current international PM context.

Notes

1. BRR: Aceh and Nias Rehabilitation and Reconstruction Agency, representative and coordinating body of Government of Indonesia in tsunami reconstruction process.
2. CCB/CCF are water-borne preservatives in which the arsenic has been replaced by Boron or Fluorine. These salts show less intense fixation and are less effective than Chromium-Copper-Arsenate (CCA). The retention required is 5-12 kg/m^3 for CCA, compared to 5-15 kg/m^3 for CCB/CCF.
3. A legal document for cross-provinces timber transportation in Indonesia, only valid per truck per travel.
4. Project concept note should be approved beforehand by BAPEL BRR, the executing agency.

References

American Quality Foundation and Ernst and Young (1993), *The International Quality Study Best Practices Report: An Analysis of Management Practices that Impact Performance*, American Society for Quality/Ernst and Young, Milwaukee, WI.

Bhote, R.K. (1987), *Supply Management: How to Make US Suppliers Competitive*, American Management Association Membership Publications Division, New York, NY.

BRE (2000), Building Research Establishment. Sustainable Construction – The Data. CR258/99, BRE, Watford, March.

BRR (2006a), Building a Land of Hope: One Year Report, Executing Agency of the Rehabilitation and Reconstruction Agency for Aceh and Nias, Banda Aceh.

BRR (2006b), *Timber Procurement and Transportation Guidelines (Draft)*, BRR, Banda Aceh, July.

BRR and The World Bank (2006), *Trucking and Illegal Payments in Aceh*, BRR and The World Bank, Banda Aceh.

Brundtland, G.H. (1987), *Our Common Future: Report of the World Commission on Environment and Development*, Oxford University Press, Oxford.

Burnes, B. and Coram, R. (1999), "Barriers to partnerships in the public sector: the case of the UK construction industry", *Supply Chain Management: An International Journal*, Vol. 4 No. 1, pp. 43-50.

Carr, A.S. and Pearson, J.N. (1999), "Strategically managed buyer-seller relationships and performance outcomes", *Journal of Operations Management*, Vol. 17, pp. 497-519.

Carter, J.R. and Price, P.M. (1993), *Integrated Materials Management*, Pitman, London.

Chen, I.J. and Paulraj, A. (2004), "Understanding supply chain management: critical research and a theoretical framework", *International Journal of Production Research*, Vol. 42 No. 1, pp. 131-63.

Chen, J.J. and Chambers, D. (1999), "Sustainability and impact of Chinese policy initiatives upon construction", *Construction Management and Economics*, Vol. 17 No. 5, pp. 679-87.

Cheung, F.Y.K., Rowlinson, S., Jefferies, M. and Lau, E. (2006), "Relationship contracting in Australia", *Journal of Construction Procurement*, Vol. 11 No. 2, pp. 123-35.

Choi, T.Y. and Hartley, J.L. (1996), "An exploration of supplier selection practices across the supply chain", *Journal of Operations Management*, Vol. 14, pp. 333-43.

Cooper, M.C. and Ellram, L.M. (1993), "Characteristics of supply chain management and the implications for purchasing and logistics strategy", *International Journal of Logistics Management*, Vol. 4, pp. 13-24.

CRISP (1999), *Integrating Sustainability and Rethinking Construction*, CRISP Sustainable Theme Group, Eaton House, Oxford.

Dale, B.G., Lascelles, D.M. and Lloyd, A. (1994), "Supply chain management and development", in Dale, B.G. (Ed.), *Managing Quality*, Prentice-Hall, London, pp. 292-315.

Darwin, J., Duberley, J. and Johnson, P. (2000), "Contracting in ten English local authorities: preferences and practice", *The international Journal of Public Sector Management*, Vol. 13 No. 1, pp. 38-57.

Department of the Environment, Transport and the Regions (2000), *Building a Better Quality of Life: Strategy for more Sustainable Construction*, Eland House, London.

Dobler, D.W., Burt, D.N. and Lee, L. Jr (1990), *Purchasing and Materials Management*, McGraw-Hill, New York, NY.

Douglass, R. (2006), *Aceh Reconstruction Timber Supply – Suggested Purchase Flow*, British Red Cross, unpublished document, July.

Dyer, J.H. (2000), *Collaborative Advantage: Winning through Extended Enterprise Supplier Networks*, Oxford University Press, New York, NY.

Elkington, J. (1997), *Cannibals with Forks*, Capstone, London.

Ford, D. (1990), *Understanding Business Markets*, Academic Press, London.

Griffith, A. (1994), *Environmental Management in Construction*, Macmillan, Basingstoke.

Hahn, C.K., Pinto, P.A. and Brag, D.J. (1983), "Just-in-time purchasing and the partnership strategy", *European Journal of Purchasing & Supply Management*, Fall, pp. 2-10.

Handfield, R.B. (1993), "The role of materials management in developing time-based competition", *International Journal of Purchasing & Materials Management*, Vol. 29, pp. 2-10.

Helper, S.R. (1991), "How much has really changed between US automakers and their suppliers", *Sloan Management Review*, Summer, pp. 15-28.

Ittner, C.D., Larcker, D.F., Nagar, V. and Rajan, M.V. (1999), "Supplier selection, monitoring practices, and firm performance", *Journal of Accounting and Public Policy*, Vol. 18, pp. 253-81.

Jarillo, J.C. (1993), *Strategic Networks: Creating the Borderless Organization*, Butterworth-Heinemann, Oxford.

Kekre, S., Murthi, B.P.S. and Srinivasan, K. (1995), "Operating decisions, supplier availability and quality: an empirical study", *Journal of Operations Management*, Vol. 12, pp. 387-96.

Kotabe, M., Martin, X. and Domoto, H. (2003), "Gaining from vertical partnerships: knowledge transfer, relationship duration, and supplier performance improvement in the US and Japanese automotive industries", *Strategic Management Journal*, Vol. 24, pp. 293-316.

Lamming, R.C. (1993), *Beyond Partnership: Strategies for Innovation and Lean Supply*, Prentice-Hall, Hemel Hempstead.

Larson, P.D. and Kulchitsky, J.D. (1998), "Single sourcing and supplier certification: performance and relationship implications", *Industrial Marketing Management*, Vol. 27, pp. 73-81.

Lascelles, D.M. and Dale, B.G. (1989), "The buyer-supplier relationship in total quality management", *Journal of Purchasing and Materials Management*, Vol. 25, pp. 10-19.

Leenders, M.R., Fearson, H.E., Flynn, A.E. and Johnson, P.F. (2002), *Purchasing & Supply Management*, McGraw-Hill, New York, NY.

MacNeil, I.R. (1978), "Contracts: adjustment of long-term economic relations under classical, neoclassical and relation contract law", *Northwestern University Law Review*, Vol. 72, pp. 854-905.

Mohr, J. and Spekman, R. (1994), "Characteristics of partnership success: partnership attributes, communication behaviour, and conflict resolution techniques", *Journal of Strategic Management*, Vol. 15, pp. 135-52.

Newman, R.G. (1988), "Single source qualification", *Journal of Purchasing and Materials Management*, Vol. 24, pp. 10-17.

Ofori, G. (1992), "The environment: the fourth construction project objective", *Construction Management and Economics*, Vol. 10 No. 5, pp. 369-95.

Pilling, B.K. and Zhang, L. (1992), "Cooperative exchange: rewards and risks", *International Journal of Purchasing & Materials Management*, Vol. 28, pp. 2-9.

Rousseau, D.M. and Parks, J.M. (1993), "The contracts of individuals and organizations", *Research in Organizations' Behaviour*, Vol. 55, pp. 1-43.

Schneider, H., Pruett, J. and Lagrange, C. (1995), "Uses of process capability indices in the supplier certification process", *Quality Engineering*, Vol. 8, pp. 225-35.

Shin, H., Collier, D.A. and Wilson, D.D. (2000), "Supply management orientation and supplier/buyer performance", *Journal of Operations Management*, Vol. 18, pp. 317-33.

Stuart, F.I. (1993), "Supplier partnerships: influencing factors and strategic benefits", *International Journal of Purchasing & Materials Management*, Fall, pp. 22-8.

Turnbull, P., Oliver, N. and Wilkinson, B. (1992), "Buyer-supplier relations in the UK automotive industry: strategic implications of the Japanese manufacturing model", *Strategic Management Journal*, Vol. 13, pp. 159-68.

Walker, D.H.T., Segon, M. and Rowlinson, S. (2008), "Business ethics and corporate citizenship", in Walker, D.H.T. and Rowlinson, S. (Eds), *Procurement Systems – A Cross Industry Project Management Perspective*, Taylor & Francis, Abingdon, pp. 101-39.

Winter, M., Smith, C., Morris, P.W.G. and Cicmil, S. (2006), "Directions for future research in project management: the main findings of a UK government-funded research network", *International Journal of Project Management.*, Vol. 24 No. 8, pp. 638-49.

Womack, J.P., Jones, D.T. and Roos, D. (1991), *The Machine that Changed the World*, HarperCollins, New York, NY.

Further reading

Burton, T.T. (1988), "JIT/repetitive sourcing strategies: trying the knot with your suppliers", *Production & Inventory Management Journal*, Vol. 29, pp. 38-41.

Galt, J.D.A. and Dale, B.G. (1991), "Supplier development: a British case study", *International Journal of Purchasing & Materials Management*, Vol. 27, pp. 19-24.

Hahn, C.K., Watts, C.A. and Kim, K.Y. (1990), "The supplier development program: a conceptual model", *International Journal of Purchasing & Materials Management*, Vol. 26, pp. 2-7.

Harland, C.M., Lamming, R.C. and Cousins, P.D. (1999), "Developing the concept of supply strategy", *International Journal of Operations & Production Management*, Vol. 19, pp. 650-73.

Khalfan, M.M.A., McDermott, P. and Kyng, E. (2006), "Procurement impacts on construction supply chains: UK experiences", paper presented at the Symposium on Sustainability and Value through Construction Procurement, CIB W92 – Procurement Systems, 2006 Conference Proceedings, Digital World Centre, Salford, November 29/December 2.

Krause, D.R. (1999), "The antecedents of buying firms' efforts to improve suppliers", *Journal of Operations Management*, Vol. 17, pp. 205-24.

About the authors

Kelvin Zuo is based at the Department of Civil and Environmental Engineering, Faculty of Engineering, The University of Auckland, Auckland, New Zealand. Kelvin Zuo is the corresponding author and can be contacted at: k.zuo@auckland.ac.nz

Regan Potangaroa is based at the School of Architecture, Unitec, Auckland, New Zealand.

Suzanne Wilkinson is based at the Department of Civil and Environmental Engineering, Faculty of Engineering, The University of Auckland, Auckland, New Zealand.

James O.B. Rotimi is based at the School of Built Environment, Unitec, Auckland, New Zealand and University of Canterbury, Christchurch, New Zealand.