

# SUPPLY CHAIN COLLABORATION IN NEW ZEALAND HOUSE CONSTRUCTION

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## ABSTRACT

Concurrent with the development of interest in supply chain management (SCM) in the broad manufacturing sector, there has been increasing interest and research in SCM in relation to construction. The construction supply chain comprises a network of project parties connected upstream and downstream to produce what the end consumer wants – much like in any production process. However in construction there is little by way of aggregation or integration in the supply chain. Indeed historically disintegration has been the default state in the construction supply chain.

The key to achieving project success within a defined timeframe is based on collaborative interactions within the supply chain. Collaboration is the key to solving issues in on-going construction. The study collects the views of construction materials manufacturers, suppliers, architects, and homeowners on the significance of collaboration in the New Zealand residential construction sector. The study collated data from 30 semi-structured interviews. Thematic analysis of the responses identified the significance of collaborative materials supply chain practices in the residential building construction sector.

The study found that collaboration is appreciated by all the parties in the construction supply chain in order to find appropriate building materials for use on projects. Further, good communication across the supply chain was identified as a key driving factor to strengthening existing collaborative efforts.

*Keywords:* Building materials, collaboration, New Zealand, supply chain management.

## INTRODUCTION

The purpose of construction supply chain management (CSCM) is to manage and co-ordinate the complete supply chain from raw materials suppliers to end users (Ryan and Bernard, 2003). It involves aspects of

design, planning and management which must be done collaboratively. Collaboration in the materials supply chain refers to the working practice whereby building materials manufacturers, suppliers, building contractors, architects and homeowners work together to successfully complete a house construction project. Ryan and Bernard (2003) further explains that collaboration must be an integral part of the building process of CSCM. The importance of collaborative supply chain practices have been shown by Miles and Huberman (1994) and Jackson and Trochim (2002) to result in the completion of projects with a higher degree of quality for an optimum cost within a given time frame. However issues related to clients and other parties in construction are only effectively addressed through partnerships, indeed "total quality management" (TQM) in the supply chain. Therefore, people in the supply chain should work together to achieve better output, increased productivity, and enhanced efficiency (Jackson and Trochim, 2002). Unlike other industries, the construction industry has shown a slower adoption of the concept of collaboration due to the well-documented distinct nature of the construction process (Akintoye et al., 2000). Also, O'Brien and Plotnick (1999), Agapiou et al. (1998), and Akintoye et al. (2000) indicated that knowledge of research in CSCM is comparatively low. Therefore the current paper attempts to identify the significance of collaboration in the materials supply chain in the New Zealand residential sub-sector of its construction industry.

Firstly, the paper reviews literature on the significance of collaboration in the CSCM. Then the paper presents the results of semi-structured interviews conducted amongst key stakeholders. Finally, the paper synthesises the different participants' views on current collaborative practices across the supply chain to generate the key benefits of collaborative building materials supply chain (BMSC) practices.

## **COLLABORATION IN THE BUILDING MATERIALS SUPPLY CHAIN**

Adoption of SCM practices into construction management can significantly benefit the construction industry (Carley and Palmquist, 1992). SCM is considered an integrated methodology for construction projects to overcome the current issues within the industry (Colorado State University, 2006). For example, Carley (1997) stated that SCM philosophy could enhance the efficiency and effectiveness of the construction industry. Agapiou et al. (1998) and O'Brien et al. (2002) also explained that SCM is a main component in the achievement of cost effectiveness in construction projects. The basic integral role of the supply chain was indicated as the integration or collaboration among the supply chain nodes which would eliminate issues in the traditional construction approach (Carley, 1997, Ryan and Bernard, 2003, O'Brien et al., 2002). However, there is much space left for further research on collaboration, trust, and networking in SCM related to construction projects (Vidalakis and Tookey, 2005).

The performance of the construction supply chain is dependent on the flow of information and materials between the project participants. When conflicts occur among homeowners, architects, contractors, suppliers, and manufacturers, these conflicts cause opportunity costs. A report produced by (DPR Construction, 2000) showed that a collaborative process in the construction industry would deliver important and extraordinary results through an organised methodology. A study conducted by Vrijhoef and Koskela (2000) introduced four roles of CSCM, focusing on reducing costs and supply chain time. Further, their study explained that the relationship with contractors, suppliers, and clients is the key to managing materials and labour flows. In addition, building materials flow can be properly controlled by good co-ordination and communication between the project contributors (Agapiou et al., 1998). Akintoye et al. (2000) showed that building contractors considered that a better quality service, cost benefits, a simple construction process, and a simple ordering process occur when supply chain relationships are built with suppliers. Akintoye et al. recommended that contractors consider cost benefits, simple construction process, simple tendering process, simple design process, and standard construction practices when supply chain relationships are made with clients. However, Barratt (2004) and Khalfan et al. (2004) stated the challenges to achieving project team collaboration in the construction industry are the fragmentation of project delivery systems, lack of trust, and adversarial contractual relationships.

## **RESEARCH METHODS**

This research is aimed at identifying the significance of collaboration in the materials supply chain for its users in the New Zealand residential construction industry. The study is interested in obtaining rich participant experiential data, therefore qualitative data collection in the form of exploratory semi-structured interviews was employed. Interviews are one of the main data collection methods used by social researchers, providing the opportunity for direct interaction between the researcher and the research participants. For this study, semi-structured exploratory interviews was selected because improvisation in the interview script is allowed and its nature supports the investigation of participants' experiences and feelings (Myers and Newman, 2007, Denscombe, 2003). Altogether, 30 participants were selected in the Auckland region, representing building materials manufacturers, building materials suppliers, building contractors, architects, and new homeowners in the New Zealand residential construction sector. Further, participants were chosen to represent small, medium, and large size companies from the aforementioned parties in the materials supply chain as shown in the demographic data in Table 1.

Table 1 Demographic Data

Participant code	Category	Role	Experience	Company size
M-01	Building materials manufacturers	Manager of the particular depot	19 years	Medium
M-02		Procurement manager	20 years	Medium
M-03		Technical consultant	35 years	Medium
M-04		Owner	15 years	Small
M-05		Sustainability manager	30 years	Large
M-06		National sales manager	25 years	Small
S-01	Building materials suppliers	General manager (supply chain)	10 years	Large
S-02		Auckland sales manager	10 years	Medium
S-03		Category manager (materials)	12 years	Large
S-04		National procurement manager	18 years	Large
S-05		Transport manager	20 years	Small
S-06		Owner	18 years	Medium
C-01	Residential building contractors	Performance improvement manager	23 years	Large
C-02		General manager	42 years	Large
C-03		Owner	40 years	Small
C-04		Commercial director	24 years	Small
C-05		Sales manager	35 years	Medium
C-06		Estimator	7 years	Medium
A-01	Architects undertaking residential building designs	Principal architect	20 years	Medium
A-02		Director	15 years	Medium
A-03		Director	5 years	Medium
A-04		Principal architect	32 years	Medium
A-05		Private single architect	35 years	Small
A-06		Business owner	40 years	Small
H-01	New homeowners	University lecturer	N/A	N/A
H-02		Retired university professor	N/A	N/A
H-03		Computer analyst	N/A	N/A
H-04		Teacher trainer	N/A	N/A
H-05		Businessman	N/A	N/A
H-06		Medical laboratory scientist	N/A	N/A

References are made to information presented in Table 1 within the results and discussion section. The research participants were coded for anonymity and the codes used to describe their responses.

### Data collection method

Semi-structured interviews for this study were conducted on a one-to-one basis as suggested by Denscombe (2003), because such interviews are simple to arrange, the opinions and views come from a single interviewee, and the researcher has control over the interview. Apart from having a clear list of issues to be examined, it also permitted the researcher more flexibility in ordering the questions asked and at the same time provided the opportunity for the participants to be candid and to speak more widely on the issues raised (Denscombe, 2003). A brief introduction and self-discloser was made to participants at the beginning of the interview process. Interviews were guided by the indicative questions prepared based on past literature, which were in accordance with the research

objectives. Participants were asked to discuss about the importance of collaboration in the BMSC and issues around current collaborative activities. All the interviews were audio recorded and transcribed by the researcher. The need for rigour in the interview analysis was established to signify the importance of interpretation of the transcribed interviews (Hughes et al., 1998, Weber, 1990). Therefore a number of key criteria were considered to interpret the interview transcripts. These comprise: identification, recognition, construction, deconstruction, reconstruction, and textualisation of themes and patterns in the transcriptions.

### **Data analysis**

A computer aided software package (QSR NVivo 10) was used to manage the qualitative data collected from the semi-structured interviews. NVivo strengthened the internal validity of the current study through an effective code management system and excellent qualitative data management functionalities.

## **RESULTS AND DISCUSSION**

This section presents the results of the semi-structured interviews. Each group of interviewees were asked to explain the significance of collaboration in the BMSC. Firstly, the views of 5 different groups of participants are presented in the next five subsections. Then, the participants' views were integrated to compare and contrast the results .

### **Views of building materials manufacturers**

Among the six building materials manufacturers that took part in the interviews, five agreed that the whole concept of collaboration within the industry is hugely important and they believed that there are direct benefits in working together with suppliers, contractors, architects, and homeowners. However, participant M-03 was uncertain about the direct benefits that would be had from collaborative practices. This participant said that:

*"On the surface it appears to be upfront but it's not, everybody backstabs everybody just to make a sale. The building industry is strictly competitive contract business, tendering, price. That's the way it is. There's four or five major players, and everybody competes with everybody else, to be honest".*

Moreover, participant M-03 commented that collaborative materials supply chain practices will certainly make the construction industry more professional. Interviewees who agreed that collaboration is important further emphasised that good communication and team work are the basis for collaboration.

Participants M-01, M-03, and M-04 expressed the view that collaboration is the customer communicating to the contractor or the architect regarding what they want, accurately. Therefore, the contractor can make sure that pricing and supplying are in accordance with what the client wants and then the contractor is ready to pass this information on to the supplier/manufacturer. This is a process to get the right material across the supply chain. In contrast, participants M-02 and M-05 said that collaboration is about bringing teams together and making sure that everyone is fulfilling their role as opposed to the tendering process which tends to cause adversarial relationships.

### **Views of building materials suppliers**

Generally all participants agreed that greater collaboration in the materials supply chain would have positive impacts. Participants believed that collaboration is working together to create a better end product that ensures quality construction in New Zealand. In addition, collaboration ensures that building contractors deliver the right products at the right time. For example, interviewee S-05 explained that:

*"Collaboration makes sure that the material that they want is available. The architect and engineer should collaborate more".*

### **Views of residential building contractors**

It was observed from the interviews that two contrasting views were held by residential building contractors. Those contractors who build houses for external clients (C-03, C-04, C-05, C-06) seemed to believe that collaboration in the BMSC is important, whereas contractors who build houses for sale (C-01 and C-02) believed that collaboration would not improve supply chain practices.

Participants who felt that collaboration is important said that homeowners come to them to find a solution to manage the design and construction, provide subcontractors, and to deal with suppliers and councils. Thus collaboration in terms of the selection of building materials by homeowners happens at the early stage of the construction process. Therefore these contractors are responsible for building strong relationships and overcome any challenges in the building process. Their perception was that maintaining good collaboration is a value that they offer in their business.

Some of the participants explained that collaboration is vertical integration and vertical integration would make savings to the client (homeowner) through economies of scale. However, these participants also pointed out that there could be potential inefficiencies in vertical integration as it could lessen competition. For example, interviewee C-04 said:

*"Many companies rely on their construction business as a means to an end. Effectively just a purchaser of products of that supply chain. It just makes it difficult to compete with more vertically integrated companies".*

Some other participants believed that collaboration would reduce the supply chain time and costs. In line with this, interviewee C-05 mentioned that:

*"Oh it's so important because we're needed on a particular day, because we have tradesmen waiting onsite to install that product. Delay costs us money directly from our profit".*

Participants who believed that collaboration is not important said that the choice of materials they used is their own choice not the designers' choice. For example, interviewee C-02 pointed out that:

*"We would sit down with designers and look at this design. But generally, we tell suppliers what we want, so our collaboration is rare for us".*

Further, these participants said that there needs to be separation because as long as the client's focus is on price then collaboration very quickly leads to collusion and the price benefits of competition are lost.

### **Views of architects**

Architects expressed the view that collaboration is about being involved in the build (e.g. staying connected with builders). Therefore, collaboration is being able to influence and able to direct things in a collaborative manner. The interviewees agreed that collaboration is slowly developing in the building industry although they accept that further collaboration would improve the BMSC in many ways. For example participant A-06 stated that:

*"It's important and it's working. We're asking for detail and we get it. Now it's quite supportive".*

Sharing knowledge among other architects and other parties in the supply chain would assist in supporting each other to overcome supply chain issues. For example, participant A-04 mentioned that:

*"We never used to talk to them but now we realise we need a bit of sort of support for what went wrong for him so we don't all go and fall in the same hole".*

Participant A-05 pointed out that collaboratively working with building contractors help to build good relationships with contractors which in turn would improve cost effectiveness.

Interestingly, participant A-06 stated that, publications put out by different parties in the materials supply chain is a way of collaboration by sharing information. Participant A-02 showed the significance of collaboration in terms of working together to negotiate various detailed necessities of specific building systems:

*"There's also a big push towards building systems, structured systems, and water-proofing systems; so that's important for us to be able to talk to specific people about how they see their systems coming in place and meeting other systems, and how those junctions can be negotiated in detail".*

Therefore, working together with variety of manufacturers and suppliers would enable contractors to manage various building system requirements.

### **Views of homeowners**

The homeowners interviewed indicated that they have had very good interactions with their architects, contractors and suppliers in choosing the materials for their residential buildings. Therefore, good communication between the parties and good relationships in the supply chain were identified as the keys to collaboration. Further, participants explained that collaboration is important to achieve the aim of building the right house with the right materials for the right cost. Though this group of participants explained that collaboration between homeowners, architects, and contractors seem distinct from that of the contractors, suppliers and manufacturers. For example, interviewee H-04 said:

*"But then I think if you think good architect, good builder, and the relationship again goes down. I think the good builder then would have relationships with good suppliers".*

Participants highlighted that collaboration helps to resolve complications that could arise when selecting right building materials. This was shown by participant H-02 who said:

*"We had the colour of the aluminium joinery, the garage door in the roof; they needed to be coordinated, they were all in silver colour. It wasn't until the builder became involved, we had resolution."*

### **Integration of participants' views**

In this section, the aforementioned views provided by the interview participants were integrated. The analysis of the interview transcripts identified that collaboration is important in achieving better materials supply chain practices. Further, the NVivo interview analysis results revealed that the key criterion in achieving collaboration is good communication across the BMSC. Moreover, 4 main themes and sub-



themes were identified from the different groups of participants as shown in Table 2.

Table 2 Key Criteria Identified using NVivo Analysis

Key criteria identified	M	S	C	A	H
<b>Theme 01: Flow of information</b>					
▪ Collaboration brings better data flow	■	■			
▪ Collaboration brings better understanding about the materials flow	■	■			
▪ Collaboration ensures materials availability and methodologies	■	■			
▪ Collaboration spreads specialized knowledge across the materials supply chain				■	■
<b>Theme 02: Team work</b>					
▪ Collaboration is working together as opposed to the tendering process	■	■			
▪ Collaboration makes strong relationships in the materials supply chain				■	■
<b>Theme 03: Right delivery time, right product, and right price</b>					
Collaboration ensures right delivery time	■	■	■		
Collaboration ensures the right product	■	■	■	■	■
Collaboration ensures cost effectiveness			■	■	■
Collaboration brings economies of scale			■	■	■
<b>Theme 04: Solving issues</b>					
Collaboration helps to solve issues in the materials supply chain				■	■
Manufacturers - <b>M</b> ; Suppliers - <b>S</b> ; Contractors – <b>C</b> ; Architects - <b>A</b> ; Homeowners - <b>H</b>					

Table 2 shows that the interviewees discussed collaboration in the materials supply chain in terms of flow of information, team work, delivering the right materials for the right price at right time, and solving issues that arise during construction project implementation process. It was found that participants’ perspectives could be categorised under the three groups of: manufacturers and suppliers (group 1), contractors (group 2), and architects and homeowners (group 3). Group 1 (manufacturers and suppliers) showed the importance of collaboration in terms of transferring materials data, team work, and attaining right products at the right time. The contractors (group 2) believed that collaboration is important in attaining the right materials at the right time for the right price. The indications given by the architects and homeowners (group 3) shows that collaboration results in increased information flow, strengthened team work, right materials, right prices, and a way of resolving issues in the supply chain. Figure 1 summarises the scenario of collaboration in the New Zealand residential construction sector which was created, using the information presented in Table 2.

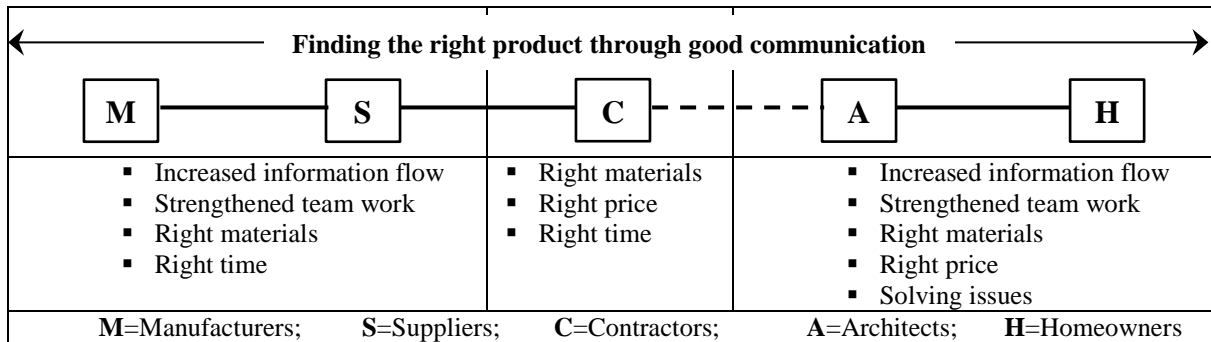


Figure 1 Collaboration in the New Zealand Residential BMSC

## CONCLUSIONS

The study examined the significance of collaboration in the BMSC. This was achieved by conducting 30 semi-structured exploratory interviews among manufacturers, suppliers, contractors, architects and homeowners in the residential building industry. All the participants are based in the Auckland region. It was revealed from the interview results that all the parties in the materials supply chain would benefit from collaborative materials supply and purchase practices. Although contractors who construct houses for sale showed that collaboration is not important as it could result in collusion and consequently lower profit margins.

The participants are generally of the view that collaboration is gradually happening in the New Zealand building industry. Although the interactions between contractors and architects/homeowners are unsatisfactory, compared to interactions between contractors and their suppliers/manufacturers in the supply chain. Therefore, improvement in the construction supply chain should be focused on contractor-architect/homeowner interaction as it is the weaker portion in terms of collaboration in the supply chain. The study's results have established that the key to collaboration is good communication among the parties in the supply chain. Collaborative decisions made by suppliers and purchasers would result in supplying or purchasing the right materials at the right price that could benefits everyone in the BMSC. The study gives a simple diagram (see Figure 1) showing the different needs for collaboration identified by the materials supply chain.

Finally the current study findings are limited to information that was supplied by the selected participants. Thus only collaboration issues related to the residential building sub-sector is considered in the study. The results of this exploratory study would need to be supported by more data from other construction sectors to enhance the reliability of the findings.

## REFERENCES

- Agapiou, A., Clausen, L. E., Flanagan, R., Norman, G. & Notman, D. 1998. The role of logistics in the materials flow control process. *Construction Management and Economics*, 16, 131 - 137.
- Akintoye, A., McIntosh, G. & Fitzgerald, E. 2000. A survey of supply chain collaboration and management in the UK construction industry. *European Journal of Purchasing & Supply Management*, 6, 159-168.
- Barratt, M. 2004. Understanding the meaning of collaboration in the supply chain. *Supply Chain Management: An International Journal*, 9, 30-42.
- Carley, K. 1997. Extracting team mental models through textual analysis. *Journal of Organisational Behaviour*, 18, 533-538.
- Carley, K. & Palmquist, M. 1992. Extracting, representing and analysing mental models. *Social Forces*, 7, 601-636.
- Colorado State University. 2006. Conducting Content Analysis [Online]. Fort Collins, USA. Available: <http://writing.colostate.edu/about/contact.cfm> [Accessed 3rd of January 2013].
- Denscombe, M. 2003. *The good research guide for small-scale social research projects*, Maidenhead, England, Open University Press.
- DPR Construction 2000. *Collaboration in the Building Process*. USA: DPR Construction.
- Hughes, W., Hillebrant, P. & Murdoch, J. 1998. *Financial protection in the UK building Industry: Bond, Retention and Guarantees*, London, United Kingdom, E & FN Spon.
- Jackson, K. M. & Trochim, W. M. K. 2002. Concept mapping as an alternative approach for the analysis of open ended survey responses. *Organisational Research Methods*, 5, 307-336.
- Khalfan, M., Mcdermott, P. & Cooper, R. Integrating the supply chain within construction industry. *proceedings of 20th ARCOM Conference*, 2004. 897-904.
- Miles, M. B. & Huberman, A. M. 1994. *An expanded sourcebook- Qualitative data analysis*, Thousand Oaks, SAGE.
- Myers, M. D. & Newman, M. 2007. The qualitative interview in IS research: Examining the craft. *Information and Organization*, 17, 2-26.
- O'Brien, J. & Plotnick, F. 1999. *CPM in Construction Management*, USA, McGraw-Hill Professional.
- O'Brien, W. J., London, K. & Vrijhoef, R. Construction supply chain modeling: a research review and interdisciplinary research agenda. *Proceedings IGLC*, 2002. 1-19.

- Ryan, G. W. & Bernard, H. R. 2003. Techniques to identify themes. *Field Methods*, 15, 85-109.
- Vidalakis, C. & Tookey, J. E. 2005. The involvement of builders' merchants in the development of improved construction logistics. Proceedings of the 2nd Scottish Conference for Postgraduate Researchers of the Built and Natural Environment, 16-17 November 2005, Glasgow Caledonian University. Rotterdam (Netherlands): in-house publishing.
- Vrijhoef, R. & Koskela, L. 2000. The four roles of supply chain management in construction. *European Journal of Purchasing & Supply Management*, 6, 169-178.
- Weber, R. P. 1990. *Basic content analysis*, London, United Kingdom, SAGE.