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# COLLABORATION IN THE NEW ZEALAND COMMERCIAL CONSTRUCTION SECTOR – A CASE STUDY OF A MEDIUM SIZED CONSTRUCTION COMPANY

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## Abstract

The New Zealand commercial construction sector is experiencing a significant economic boom. During this boom many companies are struggling to operate efficiently, resulting in failures to meet project expectations, clients being un-happy with results, and financial stress causing, in some cases, companies to become insolvent. Many of these issues relate back to the competitive nature of the industry. In an effort to become more effective, the NZ construction industry is discussing strategies for addressing the problems it faces. One strategy receiving increasing interest is how the industry could work more collaboratively across the supply-chain to improve performance. The research seeks to answer ‘is collaboration occurring in the New Zealand commercial construction sector?’ An investigation of a medium sized construction company was undertaken to assess at what stages it was working collaboratively, and whether there was an untapped opportunity for the company to be more collaborative. Findings have shown that participants are demonstrating high levels of cooperation and teamwork on-site, with a willingness to work collaboratively. However, much of this behaviour is confined to the on-site team, with limited evidence it extended beyond the construction site. Barriers to collaboration included communication problems, different mind-sets, and the diversity of understanding regarding collaborative work practice. Participants felt that a more formalized structure would be beneficial, and could provide them with the means to develop and maintain a collaborative culture. The research recommended that there needs to be greater input by leadership for facilitating effective collaborative practice in the workplace.

## Keywords

collaboration, communication, construction industry, culture

## Introduction

Working in the construction industry quickly exposes the need for understanding that working effectively and efficiently together is key to a project’s success. Many scholars agree that the construction industry can be classified as one of the most complex industries in the world making the process of successfully constructing a building extremely challenging (Behm, 2008, Shen et al., 2010, Wu, Greenwood and Steel, 2008). Traditional construction methods have encouraged competitiveness and adversarial behaviour, which does not necessarily improve project outcomes. Whereas the collaborative approach provides better outcomes, and are favoured by project participants. Rahman *et al.* (2013) highlighted that working in collaboration substantially benefits organisations in delivering projects to the set requirements, and to survive in a complex construction environment. Currently, the New Zealand construction industry is experiencing high demand, which is placing ever-increasing pressure on resources. With the industry expanding at a fast rate, it is important that best project delivery practices are implemented, which includes using collaborative working approaches (Ibrahim, Costello and Wilkinson, 2015). This investigation sought to understand whether there is a coherent understanding in the industry regarding the value of collaboration, and to what extent it is being practiced.

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From the collected data it could be used to further develop understanding, and enhance the quality of the way the construction industry operates. Gaining understanding of where the industry currently is, in terms of collaboration, could assist the government, companies and individuals with identifying actions for improvement. The research investigation also highlights how creating a collaborative environment can create potential innovation in construction practices that could enhance the future of the New Zealand construction industry

## **Literature Review**

### **The need for collaboration**

The construction industry is considered to be one of the most complex industries in the world due to the diversity of individuals, projects, and the requirements involved (Behm, 2008, Shen *et al.*, 2010). Creating a collaborative culture offers many advantages for construction project teams and companies. Advantages such as increased end product quality, high efficiency among individuals and increased innovation and learning is offered once this type of culture is in place in the project team environment (Greenwood, 2011, Torneman, 2015). Stepping into the collaborative environment and understanding the need for it is important, as it will open up prospects for the individuals and/or companies to reach the best outcome for the project.

### **Purpose of collaboration in the construction industry**

The construction industry is overflowing with management difficulties related to managing individuals and communication among team members that affects the success of projects (Chiocchio *et al.*, 2011, Behm, 2008). There is an apparent lack of communication, and management difficulties have developed through the diversity of individuals involved in the project lifecycle. Xue, Shen and Ren (2010) found that construction is one of the most erratic and complex industries with ongoing issues of “poor performance, low productivity and no competition” (p.1). As a result of the complexity and diversity of individuals involved in projects, construction is in need of a system that encourages “trust, commitment, safety, interdependence, a win/win philosophy, mutual understanding and respect, communication, problem solution mechanisms, sharing of risk and benefits, innovation and creativity” (Greenwood, 2011, pp. 301). Hughes, Williams and Ren (2012) added support for why collaboration should be adopted in the construction industry, this includes ‘external pressures’ for example, public image and government influence on how the company is run and operates and ‘internal pressures’ to achieve a more efficient working environment, enhancing productivity (p.3). This points to the construction industry being incomplete without a collaborative working environment.

Companies that work collaboratively have been able to improve project quality, efficiency, and increase innovation and learning. Quality is enhanced by creating open lines of communication, trust, transparency between individuals, and sharing knowledge, where the project team can focus and work together to achieve the best quality outcomes (Dulami and Dalziel, 2009, Hoonakker, Carayon and Loushine, 2010). Quality failures are often caused by individuals being focused on their own tasks, and not considering how communication and sharing of information reduces opportunities for solving complex problems (Jiang and Lu, 2017). Efficiency is increased in the construction process through better integration, open lines of communication, trust, transparency between individuals and sharing knowledge. As a result, the project team can focus and work together to achieve the best product (Koolwijk *et al.*, 2018, S Rahman *et al.*, 2013). Fulford and Standing (2013) also confirmed that the construction industry experiences waste from a lack of communication, technology usage, and innovative systems, when not actively or diligently employed. Working in unity will enable the project team to effectively work to create an enhanced quality of product (Meng, 2012) and collaboration increases the chance of organisations being innovative due to the project team promoting individuals to interact with each other, share valuable information, and suggest alternative solutions to difficult problems (S Rahman *et al.*, 2013, Torneman, 2015). According to Greenwood (2011) collaborative practices enhance organisational learning through sharing knowledge among all of the project

participants, and can best be realised when supported by modern procurement methods such as Design Build and Integrated Project Delivery (Franz *et al.*, 2016).

## **Understanding collaboration**

In order to move from the traditional adversarial system to a collaborative culture, a clearer understanding is needed of associated concepts and motivations from the perspectives of researchers, clients, contractors, and subcontractors. Currently, there is a broad range of understanding of what collaboration is, and the reasons for adopting it. Aapaoja *et al.* (2013) pointed out the reason why collaborative approaches are being promoted, due to the traditional procurement approach not encouraging cooperation and providing the advantages offered by a collaborative system. Given the diversity of individuals involved in the construction industry, Wu, Greenwood and Steel (2008) highlighted that in order for collaboration to be effective, cooperation of participants is needed to tackle issues like poor communication, poor quality, cost overruns, program delays, and disputes between key individuals. Son and Rojas (2011) identified collaboration as being individuals working closely together, having shared objectives, and building trust and respect. Further, Ibrahim, Costello and Wilkinson (2015) described collaboration as a system that encourages team contribution and team reward.

Clients define collaboration as an involvement of all the project participants in the organisation that share knowledge and learning, transfer valuable information to individuals, encourage trust and communication, and promote respect (Hughes, Williams and Ren, 2012). The team then works toward the best outcome in achieving the project requirements, evenly sharing risk, and celebrating project success together. Eriksson and Torbjorn (2008) supported a definition where clients define collaboration as a win – win approach. Increased co-operation among individuals and feedback from the client's side can be more easily facilitated through established trust, communication links, and respect between individuals. Once feedback is obtained from the client, they can expect to see increased quality, work efficiencies, learning and innovation and most importantly awareness that a win - win outcome is achievable (Greenwood, 2011, Wu, Greenwood and Steel, 2008).

Hughes, Williams and Ren (2012) defined collaboration as early contractor involvement and increased communication between the client and subcontractors, to increase the quality of the end product. Through incentives offered by this relatively new concept, individual talent is captured and developed through widespread teamwork and comradery among individuals in the entire organisational environment (Eriksson and Westerberg, 2011). Once contractors have defined collaboration they are then able to focus on the characteristics of early contractor involvement (M Rahman and Alhassan, 2012). Typically, once introduced, the benefits to the overall project delivery include; increased innovation, contribution to the design stage, high quality finishes, enhanced risk management and significantly increased communication, trust and problem-solving mechanisms (Eadie and Graham, 2014).

The view of collaboration by subcontractors should be considered as being critical for the success of construction projects. Chalker and Loosemore (2016) identified that subcontractors are considered, by clients, as key for ensuring the finished product is delivered to the quality, time and cost requirements expected. Collaboration from a subcontractor's can be viewed as a way of working together, easy transfer of communication, a trusting environment, respect among individuals, willingness of top management to provide subcontractors with required information, and a no-blame culture (Hughes, Williams and Ren, 2012). Loosemore (2014) stated that co-operation is favoured among subcontractors compared to the traditional method of procurement, as one of the key benefits of a system that ensures successful communication links among individuals in the organisation.

## **Mechanisms that enhance collaboration**

There are a wide range of recommended approaches for enhancing collaboration. The key approaches are discussed in order of their significance and impact. Technology use is providing some of the greatest improvements for enhancing collaboration. Building Information Modelling (BIM) is considered one of

the most influential processes available. Portwal and Hewage (2013) found that the use of BIM in construction projects significantly encourages the project team to collaborate. Azhar (2011) supported this by highlighting that the use of BIM benefits productivity and efficiency. BIM allows team members to work interactively, rather than in isolation, allowing project information to be transferred faster, enhancing innovation, increasing quality and enabling project budgets, to be achieved according to the initial plan (Azhar, 2011, Hurtado and Sullivan, 2012, Succar, 2009). Mobile technology is advancing the use of software, such as BIM, on site by providing immediate and up-to-date access to information (Changyoon *et al.*, 2013).

A focus on creating a collaborative culture is important for achieving the benefits that integrated systems offer. Ibrahim, Costello and Wilkinson (2015) identified that leadership and management support is needed for delivering a collaborative project. Top management need to support the project team, to push the project team to work together, and to respect and communicate effectively with each other. Dulami and Dalziel (2009) pointed out that workshops are a great way to encourage individuals to interact with each other. Workshops can help create a collaborative culture by enabling the key participants to feel more comfortable in sharing information, brainstorming and developing innovative solutions (Dulami and Dalziel, 2009, Kadefors, 2011, Wu, Greenwood and Steel, 2008). A learning culture can also be achieved through these workshops as individuals share valuable information. Ibrahim, Costello and Wilkinson (2015) highlighted that through sharing of information and engagement of top management, project commitment and efficiency is enhanced.

Shelbourn *et al.* (2007) pointed out that three key elements are needed – business, people and technology, to be present for collaboration to truly work. Dulami and Dalziel (2009) recommended that providing the project team with a shared project office is a way to bring those elements together. The project team can interact with each other building trust and respect, Ibrahim, Costello and Wilkinson (2015) added, incorporating a shared project office in the organisation once collaboration is established greatly motivates individuals to work together increasing individual job satisfaction. Incorporating collaborative tools creates co-operation, flexibility, and adaptability in the project team (Erdogan *et al.*, 2008).

### **Behaviours that enhance collaboration**

Communication, trust, a learning culture and motivation must be present in when creating a collaborative culture. These four characteristics highlight the importance of including behavioural approaches in the construction industry for creating collaboration. Gamil and Rahman (2017) defined communication as an exchange of ideas and information, transferring valuable information and data without delay. According to Gamil and Rahman (2017) effective communication among the project team means project outcomes can more likely be successfully achieved. In addition, Gluch and Raisanen (2009) confirmed that in the construction industry communication has been researched for years, perhaps due to the complexity of the construction industry. Erdogan *et al.* (2008) suggested that technology such as BIM greatly increases communication among individuals in the construction industry.

Wong *et al.* (2008) believed that trust plays a major role in the construction industry, especially in a collaborative environment. Accurate transfer of information in the construction industry is critical to the project team, when working together. Trust among participants is essential for open communication related to problem-solving, Laan *et al.* (2011) have identified the benefits from trust generating behaviour as having a positive influence on project outcomes. In order for construction projects to benefit from trust, there needs to be an understanding of the types of trust and how it affects a project. Research into how trust is generated on construction projects has identified two forms. The first is developed during the initial stages of working with a person through interactions and the second form is historical trust, created from either past experiences or from the reputation of an organisation (Jiang and Lu, 2017). Both forms of trust need to be understood and managed effectively in order for a culture of collaboration to emerge.

Wu, Greenwood and Steel (2008) found that the project team once stepping into the collaborative

environment must be willing to learn and change from the traditional adversarial method to a collaborative environment in delivering a project. Ibrahim, Costello and Wilkinson (2015) identified those working in an environment, aiming at collaborative practices, need individuals to exhibit relationship behaviours supportive of collaboration and there needs to be processes to promote or allow such behaviour. For the individuals to be motivated towards working collaboratively, an individual's needs must be considered (Tohidi, 2011). It was suggested by Osipova and Eriksson (2011) that incentives should be present to encourage individuals to work toward the goal and to motivate individuals towards learning and delivering high quality products. Through creating an environment that promotes collaborative relationships it can encourage those from different organisational cultures to integrate enabling effective transfer of information (Ibrahim, Costello and Wilkinson, 2015). Organisations must share information between each other, for example, problems that they have faced and how they overcame the problem (Osipova and Eriksson, 2011). By sharing information, organisations can learn and perhaps tackle and be ready for a similar problem that they could potentially face in future. Courtesy of the communication characteristic that collaborative culture provides, a learning culture can be established.

## Research Methodology

The research approach used in this investigation was a case study of a medium scale construction company located in Auckland. A case-study approach was chosen because it is an effective way to understand social interactions and how various interrelationships associated with collaborative practice are being manifested (Denscombe, 2007). The company was selected based on convenience and it is currently working towards being more effective through using collaborative practices. Eight participants were selected from a range of construction industry professionals working on the same project. The participants were selected to enable a diverse range of perspectives and opinions for answering the research question. These individuals were from diverse areas of a typical commercial construction project.

Data was gathered using face-to-face semi structured interviews with the aim to obtain descriptive data providing insights into current practice at various levels on a project. Analysis of the response data was coded to identify key terms and phrases for comparison with recommended practice (Fellows and Liu, 2009). Open and closed questions were presented to the participants and this included information regarding their role, background and experience in construction. Collaborative practice questions covered definitions used by participants, views on the level of collaboration practiced on site, the attributes they believe contributed to collaboration, the tools and techniques that best supported collaboration, and finally what the greatest barriers to collaboration were and how they could be or may have been overcome.

Collaboration is a concept that requires a wide range of people to work effectively together solving complex problems. Participants needed to be chosen to represent a range of working roles within a construction project. The aim was to choose participants who have had different construction industry experience to gain diverse data for analysis and comparison with the literature. A convenience sampling approach was used to select participants that represented clients, main contractors and subcontractors from a commercial construction project, see Table 1

*Table 1. Participant roles, years and project involvement*

<b>Role</b>	<b>Industry Experience</b>	<b>Project Involvement</b>
<i>Project Manager</i>	<i>35 years</i>	<i>Commercial</i>
<i>Director/CEO</i>	<i>33 years</i>	<i>Commercial, industrial, warehousing, retail, health, retirement, community, seismic retrofitting and strengthening, building reclads, design &amp; build</i>
<i>Director/Construction Manager</i>	<i>33 years</i>	<i>Commercial, health, retirement and education</i>
<i>Client</i>	<i>20 years</i>	<i>Industrial</i>

<i>Quantity Surveyor</i>	<i>25 years</i>	<i>Commercial</i>
<i>Site Manager</i>	<i>14.5 years</i>	<i>Commercial and retirement</i>
<i>Subcontractor (Plumber)</i>	<i>7 years</i>	<i>Commercial, warehousing and residential</i>
<i>Construction Manager Cadet</i>	<i>2 years</i>	<i>Commercial</i>

## Findings & Discussion

The participants were questioned relating to how they would define collaboration. Participants provided a varying array of descriptions, as seen in Table 2. Six of participants' responses aligned with the notion that working collaboratively included elements of an environment of open communication, freely sharing information and having a supportive culture of trust and respect in order to create an atmosphere for effective problem solving. Participants commented that working together as a team achieving the project requirements successfully is the short answer to defining collaboration. There was a strong sense of the value of teamwork amongst the participants when asked to define collaboration. This was evident when analysing the definitions, as most of them mentioned either 'team work', 'team' or 'working together' in all the collected data. All participants felt that they have a good understanding of what collaboration involves, and were able to articulate many key requirements as described in literature.

*Table 2. Collaboration defined from construction industry professionals*

<i>Participants</i>	<i>Definitions</i>
<i>Client</i>	<i>Working as a team to get "buy in" to the project by consultants, contractors, sub-contractors and clients.</i>
<i>Director/CEO</i>	<i>We are seeing an increase in collaboration with some clients generally through and ECI process. This is generally with clients or teams who see the benefit of a collaborative approach. The ECI process allow buildability, traffic management, construction management, financial management all to become part of the design process with the end goal being a better outcome for the client and team.</i>
<i>Director/Construction Manager</i>	<i>The sharing and gathering of information/experience to aid and support the commercial benefits for the partner involved in the dialogue.</i>
<i>Project Manager</i>	<i>A number of people/companies working together to complete a task/project.</i>
<i>Site Manager</i>	<i>When individuals work together as a team, communicating freely sharing information, respecting one another and motivating each other to achieve the outcome set by the client.</i>
<i>Quantity Surveyor</i>	<i>Using combined knowledge to come up with most efficient design and implementation.</i>
<i>Construction Manager Cadet</i>	<i>Sharing problems with one another and achieving project requirements together in a joint effort.</i>
<i>Subcontractor (Plumber)</i>	<i>Involvement from all parties in the project. Sharing information with the construction industry chain, as well as communicating unforeseen problems and fixing them together and having a no-blame culture.</i>

The construction company's focus was on promoting collaborative practices in its projects. Using the definition of collaboration from the perspective of clients, contractors and subcontractors, participants were asked to identify the extent they believed the construction company works collaboratively. Participants were asked to identify the key issues that would increase collaborative practices. Two key components were identified being: a positive attitude towards working collaboratively; and top management providing support and encouragement.

Another question focused on whether the participants had a collaborative working environment in their project team. Table 3 provides a summary of participant comments, where data showed that a collaborative working environment was present in the project team. Most of the participants commented that sharing ideas, problems and working jointly together to encourage an atmosphere of teamwork was what they are doing to achieve a collaborative working environment. The participants' discussion

regarding the outcomes of the project once collaboration is implemented highlighted that project outcomes cost, quality and time are achieved. Osipova and Eriksson (2011) pointed out in their report that once a collaborative system is introduced/implemented in the company and religiously followed, quality outcomes are achieved. One of the participants (Director/CEO) strongly encouraged collaboration, but limitations exist at the construction stage, where the project team lacked input during the construction stage thereby limiting the opportunity to realise the full benefit of collaboration. The Director/CEO's observation reflected research where the traditional Design-Bid-Build procurement approach can limit the scope of the benefits available from early contractor involvement and collaboration on construction projects (Nikou Goftar, El Asmar and Bingham, 2014, Franz *et al.*, 2016)

*Table 3. Summary of current collaborative working environment outcomes*

<i>Participant</i>	<i>Collaborative environment</i>	<i>Outcomes</i>
<i>Client</i>	<i>Yes</i>	<i>Allows everyone an equal opportunity to have a say over important decisions.</i>
<i>Director/CEO</i>	<i>Yes</i>	<i>We encourage collaboration but are often limited to our input during the construction phase. Unfortunately, too often it is too late to make the most of it and our inputs become more reactive in regard to design documentation.</i>
<i>Director/Construction Manager</i>	<i>In part</i>	<i>Increasing the number of meetings between the parties to try and bridge the individual/company barriers.</i>
<i>Project Manager</i>	<i>Yes</i>	<i>We work as the conductor of information transfer between all parties to facilitate the timely turnaround of queries/shop drawing reviews/programming requirements, etc.</i>
<i>Site Manager</i>	<i>Yes</i>	<i>We are sharing information and working together to achieve the required outcomes. It looks like by having collaboration in the project team, work efficiency and better working environment in achieved.</i>
<i>Quantity Surveyor</i>	<i>Yes</i>	<i>Questioning site staff for easier/accurate costing of variations. Listening to site staff and communicating to encourage team work hence achieve project outcomes.</i>
<i>Construction Manager Cadet</i>	<i>Yes</i>	<i>Sharing information in the project team, working together results in less stress and better project delivery. We share information by communicating, due to communicating freely we have better decision making and prevent major issues on site, all of this is due to good communication links.</i>
<i>Subcontractor (Plumber)</i>	<i>Yes</i>	<i>Navigating through a list of tasks given to junior cadet/apprentice. In this way they and I develop collaborative working environment. We are constantly communicating between co-workers that builds a good relationship which later really helps to finish the job successfully due to everyone working jointly.</i>

Participants were then given a statement “*Collaboration is a key mechanism for improving project success*” and asked to identify to what degree they agreed or disagreed. Out of the 8 participants, 4 strongly agreed and 4 agreed with the statement. It was found that participants shared the view that working as a team and sharing project information was a pathway toward collaborative practices being implemented in the company. This was consistent with Rahman *et al.*, (2013) who stated that with increased communication levels between project participants within a collaborative project environment, increased quality finish, timely project completion meeting the cost target was one of many positive attributes when working collaboratively. Therefore, it is considered to not only be good practice to encourage a collaborative working environment to achieve project outcomes, but to also maintain a friendly social atmosphere, and a win – win philosophy, innovation and creativity, all resulting in project

outcome success (Dulami and Dalziel, 2009).

### Attributes achieved when undertaking collaboration

Participants were then asked to identify the attributes they believed are achieved when working collaboratively in projects. The participants' responses showed they believed all the attributes presented to them in the questionnaire are achieved. The attributes were based on the work by Wu, Greenwood and Steel (2008), which these included: improved project outcomes, problem solving, chances of a win-win outcome, more openness and teamwork, no-blame culture, learning opportunities, better communication and commitment, and greater respect amongst project participant.

### Support for a collaborative working environment

Participants were asked to complete the following statement: *I enjoy working collaboratively because...* The responses in Table 4 indicated that all the respondents enjoy an environment that encourages problem solving and knowledge-sharing-practices, because they improve the project environment and project outcomes. None of the participants provided negative statements regarding collaborative working. Overall, the responses demonstrate the types of positive attitudes needed by individuals for an effective collaborative working environment, as discussed by Xue, Shen and Ren (2010).

Table 4. Responses to statement – “I enjoy working collaboratively because...”

<i>Participants</i>	<i>Responses</i>
<i>Client</i>	<i>Everyone has different experiences, which could add to an improved outcome</i>
<i>Director/CEO</i>	<i>Project success is subjective. There are many factors that affect and define success. Collaboration is only 1 factor</i>
<i>Director/Construction Manager</i>	<i>Project outcomes are achieved as well as better working environment.</i>
<i>Project Manager</i>	<i>A problem shared is a problem halved which results in increased productivity.</i>
<i>Site Manager</i>	<i>Everyone can contribute to the job equally by sharing information and communicating. Equal opportunities to participate in the project make the atmosphere at work more enjoyable.</i>
<i>Quantity Surveyor</i>	<i>Tapping into knowledge of other parts of the team is the most efficient way of working.</i>
<i>Construction Manager Cadet</i>	<i>New skills are learned from experienced colleagues because of the sharing of information that is held by individuals.</i>
<i>Subcontractor (Plumber)</i>	<i>It creates fewer problems, no blame culture. Creates a better working atmosphere as well as a social team-working environment.</i>

### Enhancing collaboration through tools/methods

Participants were asked to indicate which tools are currently used in their projects to facilitate collaboration. Most of the participants identified that phones, tablets for job site coordination; company cloud, joint project office and joint project team workshops are being used. Phones were used to communicate between individuals; tablets for jobsite coordination are used to record, and check and send data to the appropriate personnel to action certain remedial work; company cloud was used to store information, joint project office was used to undertake monthly meetings, and joint project team workshops were used to undertake meetings where individuals discussed problems, solutions and general strengths gained in the project cycle.

Table 5. Tools/methods ranking

Participants	Phone	BIM	Tablets	Cloud data	Joint project Office	Joint project Weekly/Monthly workshops
<i>Client</i>	4	5	4	4	3	3
<i>Director/CEO</i>	5	3	4	5	5	4
<i>Director/Construction Manager</i>	4	2	3	3	2	4
<i>Project Manager</i>	5	4	5	4	5	5
<i>Site Manager</i>	5	3	5	5	5	5
<i>Quantity Surveyor</i>	5	3	5	4	3	3
<i>Construction Manager Cadet</i>	5	4	5	5	5	5
<i>Subcontractor (Plumber)</i>	4	2	5	5	5	5
<i>Total Score</i>	37	25	36	35	33	29

According to Baiden, Price and Dainty (2016) collaborative tools and methods need to be present in a company to encourage communication among key participants and to be effective within the organisation. Participants were asked to rank the tools they felt were the most effective for enhancing collaboration (refer to results in Table 5), based on 1 being not effective and 5 being highly effective. The majority of scores were positive, BIM had the lowest overall score. Most of the tools are used on site, with the exception of BIM. This was due to the high cost and skills required to operate the system. The majority of participants used phones and/or tablets for jobsite coordination, and the company cloud for data sharing, joint project office and joint project weekly/monthly workshops as a way to enhance collaborative practices. This was in line with Dulami and Dalziel (2009) who pointed out that there is a need to incorporate tools like workshops and joint project office where the team can cooperate with each other. The participants were given a chance to state what systems they would like to have in the company that would contribute towards increased collaboration on projects. While workshops received the second lowest rating, participants thought that running more frequent workshops would encourage social interaction and contribute towards better collaboration on projects. In a study conducted by Ibrahim, Costello and Wilkinson (2015) frequent team building workshops needed to be present to create a positive team environment, where co-workers can feel that their knowledge and input to the project are appreciated by the project team.

### **Barriers preventing effective collaboration within the company**

Barriers for the participants included matters such as, open communication among project participants and different mindsets that were preventing effective collaboration within the company. Behm (2008) supported this finding that due to the diversity of individuals in the construction industry, different mindsets can be a barrier for collaboration in project teams. Gamil and Rahman (2017) also found the significance of communication in a collaborative project delivery approach where the exchanges of ideas and transferring project information is only done through open lines of communication. Participants identified language and cultural differences across the projects as two of the many barriers that prevent collaboration within the company. This is reiterated in a study-conducted by Behm (2008) that found that the construction industry is the most complex industry in the world due to the diversity of individuals involved in the construction process.

### **Behaviours and methods required for supporting a collaborative environment**

The participants were asked which behaviours individuals need, and what methods can support those behaviours in order to have a collaborative environment. The results showed that behaviours listed included: openness; trust; honesty; authenticity; being a team player; a bias for learning and discovery; tolerance; consistent transparency; motivation; and striving for continuous improvement. This is in line with Xue, Shen and Ren (2010) who suggested that in the construction industry, especially when undertaking a collaborative project delivery approach, individuals must have behaviours that encourage collaborative project delivery practices. Some participants expressed other behaviours that individuals

should have, such as strong leadership, being enthusiastic towards work, self-drive, and most importantly being able to work with diversity. Ibrahim, Costello and Wilkinson (2015) added that strong leadership must be present to encourage and facilitate effective worker behaviour toward a collaborative environment. Participants recommended that leaders needed to model collaboration – “be prepared to do what you want others to do”, to ensure bonding as a team, more formalised meetings at the end of the project discussing what went wrong, what went well and what could have been done better. Wu, Greenwood and Steel (2008) findings support these findings, which point out that formalised meeting/workshops provides a solid structure for fostering collaboration in the project team. A subcontractor commented that leadership/top management should visit the site more frequently; as this would encourage better involvement among the project team members. A quantity surveyor noted that site meetings run by leadership/top management would result in everyone being on the same page. The director added that top management should set clear objectives for the team and actively be part of a team. This is in line with Shelbourn *et al.* (2007) who pointed out their strategies such as shared vision where goals can be set and met, technology that could aid with information transfer, and top management commitment to encourage and help the lower construction hierarchy workers to work in cooperation be built into the company’s vision.

Finally, participants thought that having competent people in the construction project cycle with everyone participating and encouraging one another is required for a collaborative working environment. The main theme identified in the findings, which respondents have pointed out is that extensive teamwork is required to maintain a successful team-working environment. However, this was not a focus of the investigation, but was reaffirmed in a study conducted by Tohidi (2011) who stated that extensive teamwork is required in a collaborative environment as its one of the branches that can lead to an improved work atmosphere.

## **Conclusion**

The research has presented a snapshot of an Auckland commercial construction project with a representative sample of project participants from diverse roles and experiences. The questions asked were designed to elicit responses regarding the level of ‘collaboration’ in the New Zealand commercial construction industry. When looking at whether or not individuals are experiencing collaborative practices on site, the study clearly indicated that there are, however many gaps and inconsistencies in collaborative practices. There is strong evidence of effective teamwork occurring, but the findings pose a question as to whether all participants interviewed fully understood collaboration, as studies indicated that before working collaboratively, individuals must first understand its meaning.

In terms of collaborative practices occurring on site, it was evident that a positive and supportive attitude existed towards the extent the company was promoting collaboration. Participants identified that key attributes associated with collaborative practices were present on site and that the work methods and tools used were positively contributing towards the facilitation of a collaborative working environment. However, there were limitations for the company regarding the use of technology, such as cost and capability, which impacted on their ability to fully engage in collaboration as facilitated by technology. Of the barriers preventing effective collaboration within the company, the biggest barrier was effective communication, due to the diversity of people working on-site. In terms of promoting collaboration, participants pointed out that more frequent meetings or workshops would help enhance a collaborative working atmosphere by allowing the opportunity, for example, to open up, share ideas and problems, and to encourage and facilitate a cooperative atmosphere.

The literature on collaboration identified the types of antecedents needed in order for collaboration to occur. A key factor was for leaders to have a clear understanding of collaboration and how to actively promote collaboration in order to achieve the best results. The study provided some guidance as to where the New Zealand construction industry, and in particular the company investigated, sits in relation to collaborative practices. The research concluded that the Auckland commercial construction company is not 100% familiar with what is required for collaboration, but is well aware of the advantages achieved through a collaborative working environment, and are actively promoting collaborative practices. In

order to move forward, it appears that participants want more input from their leadership and management.

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