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## **Capitalising teamwork for enhancing project delivery and management in construction: Empirical study in Malaysia**

### **Abstract**

**Purpose** - Teamwork in the construction industry has attracted much attention from both academic and industrial circles. Most importantly, improving team effectiveness will increase the likelihood of successful project delivery. Recognising the factors influencing team dynamics is important for enhanced team performance.

**Design/methodology/approach** – Based on a detailed literature review, a survey questionnaire containing 10 aspects and 25 attributes of teamwork relevant to construction is used to collect feedback from Malaysian construction practitioners from client, consultant, and contractor organisations to prioritise these hypothesised variables. The data are then subjected to reliability analysis, descriptive statistics (means, standard deviations, and frequencies), a one-sample *t*-test, the Kruskal-Wallis ANOVA, and exploratory factor analysis.

**Findings** – The significance of these aspects and attributes is then presented. The three most crucial aspects are ‘project performance’, ‘decision-making capability’, and ‘problem-solving ability’. The most influential attributes are ‘effective communication between project team members’, ‘efficient team leadership’, ‘well-defined team responsibilities and roles’, ‘clear team goals and objectives’, and ‘good collaboration between all project leaders’. The Kruskal-Wallis ANOVA reveals five attributes having statistically significant differences with respect to company size, namely ‘clear team goals and objectives’, ‘commitment to the project’, ‘adequate resources’, ‘team or task processes’, and ‘creativity and innovation’. Six underlying dimensions are found, comprising (1) participative engagement and task commitment; (2) team

responsibility structure and accountability; (3) culture of trust and respect; (4) leader's skills and abilities; (5) top management support; and (6) synergic working environment.

**Practical implications** – The identification of these dimensions for team effectiveness provides rigorous basis for formulating useful team-building strategies for integrating a collaborative environment among project stakeholders and consequently improving project performance.

**Originality/value** - This paper bridges the identified knowledge gap concerning the dimensionality of teamwork attributes in construction-based setting and adds to existing knowledge of how team effectiveness can be leveraged to improve project performance in the construction management literature.

**Keywords:** Construction; teamwork; team effectiveness; dimensions; temporary project team; project management

## **Introduction**

Construction work is project-based, with an engineer-to-order project delivery processes. Each project requires professional practitioners with diverse backgrounds, knowledge, and experience of temporarily working collectively to attain project objectives within a predefined deadline. The typical parties comprise the client/owner, design consultants, cost consultants, contractor, specialist sub-contractors, and suppliers.

However, there is an ongoing disenchantment with construction project delivery because of poor project outcomes, resulting in owner dissatisfaction with such issues as cost overrun, late completion, and poor quality (Mpofu et al. 2017; Yap et al. 2019a). Many studies support the notion that communication breakdown, poor coordination, lack of commitment, low morale,

insufficient knowledge, and conflict between project participants are prevalent managerial inefficiencies, and ineffectiveness attributable to mistrust, lack of transparency, limited knowledge sharing, fragmented structure, and adversarial relationships between interdisciplinary professionals is responsible for unsatisfactory project delivery (e.g. Chang and Lin 2015; Koushki et al. 2005; Mpofu et al. 2017). This, in turn, often results in a 'blame culture'; avoiding responsibility and giving excuses for poor performance (e.g., Al-Kharashi and Skitmore 2009; Baiden et al. 2006). As such, poor teamwork is reported to result in excessive rework, low productivity, and frequent changes, all of which are major factors undermining construction project performance (Yap et al. 2019a; Ye et al. 2014). Existing project delivery practices inhibit collaboration (Hamzeh et al. 2019); making the management of construction projects challenging.

To address project delivery problems, practitioners and researchers are increasingly concerned with improving team management to enhance communication, establish better cooperative arrangements, and increase productivity. Previous studies indicate that teamwork creates the human synergy needed for a team-based setting such as construction to function effectively and successfully deliver projects; notable examples include Che Ibrahim et al. (2015), Chow et al. (2005), Fellows and Liu (2012), Fong and Lung (2007), and Svalestuen et al. (2015). Although studies investigating the phenomenon of teamwork in project-based environments, and its implications on project outcomes, in particular, could help better inform team management, such research in construction and engineering management remains limited. For example, Anantatmula's (2015) propose a project performance management model focuses on a cohesive project team but failed to acknowledge the key parameters that influence team integration and collaborative culture.

Another earlier study by Cheung et al. (2011) examined the organisational culture factors in Hong Kong and again failed to appraise how these affected the local industry mentality towards teamwork in construction. A year later, Yong and Mustaffa (2012) claim that a paradigm shift from traditional adversarial relationship and opportunistic behaviour in the Malaysian construction industry's practices towards a mutual working environment is one of the crucial remedial measures needed for many of the industry's problems. This focuses solely on the relationship-based procurement approach and makes no attempt to explore the teamwork-based factors needed to improve competence, commitment, and communication in construction projects.

Recently in New Zealand, Che Ibrahim et al. (2018) conducted 25 in-depth interviews with alliance practitioners to gain deeper insights into team integration. They underscore that a team-centric approach which encompasses four elements of task and relationship-oriented behaviours, collaborative learning environments, cultivating cross-boundary networks, and collaborative governance are needed to improve collaborative relationships between diverse organisations.

Moreover, the best set of outcomes for the teamwork aspects in construction is not clear, as they are often defined and measured differently across various industries (Liu and Cross 2016). As highlighted by Kwofie et al. (2015), there is a lack of consensus over the elements that are crucial to developing effective teams globally. There also remains a substantial gap in knowledge of the dimensionality of teamwork attributes in the construction industry, particularly in developing countries (Delgado Piña et al. 2008; Latif and Williams 2017). Here, the term 'dimensionality' refers to the underlying factors (latent constructs) that engender collaborative project management. Therefore, research and theories of team effectiveness that

shed light on how well the team works together remain incomplete and certainly deserve further exploration.

In response, therefore, this study aims to make a contribution by examining teamwork in construction project delivery and how its effectiveness can be leveraged to improve project performance. The specific objectives are:

- to identify and rank the aspects of teamwork in a project-based construction setting
- to examine the critical attributes affecting team effectiveness in construction
- to assess the degree of agreement on the ranking of the attributes based on company size
- to uncover the underlying dimensions of these attributes using factor analysis

There are four main parts in this paper, the theoretical background which establishes the present state of knowledge of teamwork in a construction project-based setting. This is followed by the methods used for the study, the analysis, results, and discussion of the aspects, attributes, and underlying dimensions of teamwork, and conclusions drawn. These are presented in a concise and coherent manner within the words limit imposed by the journal.

## **Literature Review**

Levi (2016, p. 28) describes a team as “a special type of group in which people work interdependently to accomplish a goal.” Tarricone and Luca (2002, p. 56), however, elucidate “teamwork implies that individuals work in a cooperative environment in the interests of a common goal by sharing knowledge/skills and being flexible enough to serve multiple roles.” Given these explanations, teams typically are engaged in activities working toward a common purpose, where members have specialised expertise relating to their tasks (Levi 2016). In this connection, both task-specific and interpersonal skills are important traits of good ‘team players’. In essence, teamwork concerns how a group of people with different skills, expertise,

and personalities can work harmoniously together to accomplish quicker and higher quality outcomes that are more efficient, thoughtful, and effective.

Delgado Piña et al. (2008, p. 7) assert that “understanding effectiveness is a key issue in team research”, while also bringing to light that most studies focus on identifying the critical factors involved, but considerably less so on the dimensions and effectiveness indicators involved – their review of team effectiveness identifying three principal dimensions of performance, attitudinal outcomes, and behavioural outcomes. In a later study investigating team effectiveness in non-governmental organisations (NGOs) in Pakistan, Latif and Williams's (2017) factor analysis of responses from 157 team members and leaders reveals seven dimensions: namely, relating to coordination between teams, connection with the community, team orientation, competencies and patterns of behaviour, effective leadership communication, empowerment and transparency, and team genesis.

Freire et al. (2018, p.121) emphasise that “teamwork does not automatically arise” but requires a bigger sense of collective ownership, shared leadership, and increased communication. The culture of cooperative orientation is associated with effective working relationships, openness, and mutual respect, which can help enhance productivity (Nguyen and Watanabe 2017). In addition, managing and improving team dynamics is needed for knowledge sharing in collective learning (Yap et al. 2019b). Social influence may affect opinions and attitudes; conformity, for instance, essentially involves acceding to group pressure (Levi 2016). On the other hand, group polarisation and groupthink are problems associated with poor team decisions due to disagreements, negative emotions, time pressures, and external stress (Essens et al. 2005; Gorse and Emmitt 2007). Thus, developing, sustaining, and maximising the effectiveness of high-performance teams is important for delivering better outcomes.

## ***Teamwork in Construction Projects***

The construction industry is traditionally fractured and interdisciplinary project teams are usually assembled and organised temporarily for a single project (Chow et al. 2005; Fellows and Liu 2012) – involving the processes of communicating, coordinating, and transforming tacit knowledge into explicit building products (Idi and Khaidzir 2018). Thus, the lack of continuity of team members for different projects intensifies the difficulty in engendering collaborative and integrated working in the industry (Assaf et al. 2014). Moreover, the members have no influence over who they work with and often have only limited experience of working together (Svalestuen et al. 2015), adversely affecting outcomes when team collaboration fails (Bishop et al. 2009), or at least resulting in a lack of effectiveness that prevents teams from realising their potential and improving their performance (Kwofie et al. 2015).

Assaf et al.'s (2014) analysis of Saudi Arabian construction projects affirms that project team effectiveness directly and positively predicts project success, the major factors being associated with organisational structure, and the aspirations and leadership of the team. In this regard, assigning the right personnel based on their roles, skills, knowledge, and characteristics is important to enhance team integration, effectiveness, and performance (Kwofie et al. 2015). To gauge group cohesion, Franz et al. (2016) consider goal commitment, team chemistry, and timeliness of communication. In this vein, promoting positive interactions encourages mutual support, boosts morale, promotes creativity, and improves work satisfaction (Buvik and Rolfsen 2015; Saha and Kumar 2017). To improve the performance of teamwork, Shafie and Samari (2014) suggest allocating the correct personnel with the right expertise, encouraging appreciation, acknowledging the diversity in strengths, and enhancing interpersonal skills for open communication.



According to Fong and Lung (2007, p. 157), inter-organisational teamwork refers to “the project team, which is made up of representatives from the owner, designer, and/or contractor organisations that are involved together in producing the results”. Likewise, the interview participants in Mueller's (2015) study assert that cooperation teamwork leads to the success of the individual, the project team, and organisational levels, as no single person can perform all the tasks needed. Liu and Cross's (2016) questionnaire survey of 133 teams from various industries and diverse project types to appraise the technical performance of the project team, using effectiveness, efficiency, and innovation dimensions, finds the significant predictors of team *effectiveness* to include management support, cooperation, and communication, while team harmony, collaboration, and goal clarity are positively linked to team *efficiency*. The factors that support innovation comprise cohesion and competence. Intriguingly, their study found that team harmony significantly hampers efficiency and innovation. They further argue that innovation is further induced by task-related conflict, and tends to be hindered by relationship conflict. In addition, team efficiency is influenced by the extent of functional diversity.

Trust and collaboration are important ‘human factors’ contributing to project management success (Strahorn et al. 2017). Collaboration is associated with physical proximity, interaction, commitment, harmonisation, conflict, and incitement (Baiden et al. 2006; Dainty et al. 2006). The level of trust, however, is attributed to the anticipation of future associations, sharing of information and knowledge, and trust imported from other familiar settings (Bond-Barnard et al. 2018). As underscored by Liu et al. (2015), increasing team agility tends to produce better team performance. The determinants of team agility in high-tech industries include cooperation, team empowerment, and competition. They also report that team climate (collectivism and team politics) and leadership factors (transformational and transactional) affect team dynamics. Regarding knowledge exchange, inhibiting factors include mistrust

between members, lack of team synergy, hiding knowledge, short-term relationships, and team transience (Nesan 2012). Given that tacit knowledge is often shared informally by face-to-face communication, a degree of trust and team cohesion is necessary (Mueller 2015). In view of this, practitioners can conceive of learning in project-based environments by having a more social orientation (Sense 2008).

### ***Teamwork Aspects in Construction***

Most construction projects necessitate some form of teamwork to achieve the objectives set and to meet the owners' changing requirements. Efficiency management, less conflicts, and reducing wastages and rework are critical factors for enhancing team performance in construction-based organisations (Shafie and Samari 2014). In this connection, the prevailing challenges of effective teamwork encompass bad leadership, poor group dynamics, and frequent breakdowns in communication (Adu and Opawole 2019). Well-functioning teams can outperform individuals through the combined efforts of their members (Baiden and Price 2011; Mcewan et al. 2017). The aspects of team effectiveness that contribute to enhancing the performance of construction projects, as drawn from key research studies, are summarised in Table 1 in order of frequency of occurrence in the literature.

[Please insert Table 1 here]

### ***Attributes Influencing the Effectiveness of Teams***

Human-group theories provide insights into the sociological and psychological parameters that guide group work interactions (Rwelamila 1994). There is a strong relationship between social

interdependence theory and successful team endeavours (Tarricone and Luca 2002). Intrinsically, the essential attributes for effective teamwork need to be recognised for team-based projects. To motivate higher performance, teams need effective management (Shafie and Samari 2014). In a recent study of the influence of teamwork on project delivery in the Nigerian construction industry, the 5 most significant attributes (of 16) comprise team leadership, top management support, interpersonal dynamics of team, clarity of expectation and objectives, and open communication (Adu and Opawole 2019). Preparation of a list of comprehensive attributes was a critical step for the success of this study. A detailed background review reveals 25 significant attributes associated with teamwork and relevant to the construction industry. These are summarised in Table 2 in order of frequency of occurrence in the literature.

[Please insert Table 2 here]

## **Research Methodology**

A positivist paradigm is adopted and a quantitative research design subsequently used, involving a field survey for collecting empirical data. This approach was chosen because of its objectivity and practical reliability in evaluating team efficiency where phenomena are observed and then theories developed from the observations (Creswell 2014). Having construction industry practitioners as the unit of analysis, a field survey enables data to be collected from a relatively large sample of people from a pre-determined population (Ling and Khoo 2016).

### ***Questionnaire Design***

To determine the relevant variables involved, a detailed literature review and discussions with industry practitioners were first carried out. This identified 10 aspects (Table 1) and 25

attributes (Table 2), from which the questionnaire was developed and drafted in plain language to ensure clear and concise communication for the respondents to exercise sound judgment. To avoid survey fatigue-reducing data quality, the questionnaire was kept short for taking around 15 minutes to complete.

The questionnaire comprises three distinct sections. The first seeks the respondent's demographic profile, comprising the respondent's company type, age, level of education, working experience, company size, and most familiar procurement type. In the second section, the respondent is asked for the level of agreement with each of the 10 aspects of an effective team on a five-point Likert scale from 1 (strongly disagree) to 5 (strongly agree). The third section involves rating the 25 team effectiveness attributes on another set of five-point Likert scale from 1 (not important at all) to 5 (extremely important).

### ***Data Collection***

The sampling frame consists of construction industry practitioners from client, consultant and contractor organisations in Malaysia with 'hands-on' experience in project delivery, using non-probability convenience and snowball sampling – techniques that are commonly used in construction management studies to attain an appropriate number of responses (Ling and Khoo 2016; Zuo et al. 2018). This approach is consistent with Kwofie et al.'s (2018) reasoning for situations where there is shortage of built environment professionals with sufficient relevant experience.

The field survey was administered through face-to-face delivery to promote respondents and raise the response rate, and by e-survey through email as an efficient way to extend the reach of the survey. Overall, 370 questionnaires were dispatched in this way. Over a period of six

weeks, 121 valid returns were received; comprising 55 and 66 from personal meetings and emails with an overall response rate of 32.7%, which is consistent with similar previous surveys within the Malaysian construction industry (Wang et al. 2018; Yap et al. 2019a). According to Fellows and Liu (2015), a sample size exceeding 100 is usually adequate for reliable statistical analysis, while the free parameter ratio of 4.84 times the number of variables satisfies the pretest criterion for factor analysis (Hair et al. 2010).

Table 3 summarises the demographic profile of the 121 respondents, with 58.7% currently attached to construction firms while 17.5% and 24.0% are from developers and consultants respectively. They are quite evenly distributed according to small (less than 50 employees), medium (51 to 200 employees), and large (exceeding 200 employees) company sizes, and nearly half have been involved in the traditional project delivery method. The majority (approximately 88%) is between 20 to 39 years of age; while 95% hold Bachelors or higher degrees. 40% have more than 5 years' experience in the construction industry.

[Please insert Table 3 here]

## **Research Findings and Discussion**

The collected data were subjected to quantitative analysis using Statistical Package for Social Sciences (SPSS) Version 23 to determine the meaningful relationships between the variables. The main statistical methods used were reliability analysis, descriptive statistics (means, standard deviations, and frequencies), a one-sample *t*-test, the Kruskal-Wallis ANOVA, and exploratory factor analysis. The results are presented and discussed below.

### ***One-Sample t-Test and Ranking of Teamwork Aspects***

Cronbach's  $\alpha$  is 0.820 for the 10 aspects appraised, which is greater than the 0.70 threshold needed to indicate internal consistency reliability for the agreement scale used (Hair et al. 2010). In order to determine the order of significance of the teamwork aspects, the mean scores and standard deviations were calculated from the five-point agreement scale used in the questionnaire. As Table 4 indicates, nine aspects have mean scores above 4.0 except for one role, namely 'preparation for future' (mean = 3.917). The one-sample *t*-test result (value=3) indicates this role is also perceived as important at the 0.01 level of significance. This is perceived as less critical, as construction involves assembling various professionals from different organisations to work on the same project for the agreed contract duration. Notwithstanding the complex nature of a transient and tailored approach to project delivery, Buvik and Rolfsen (2015) note that prior socialisation between team members can significantly affect the future interactions between members. Their findings suggest that positive past-shared experiences provide a foundation for trust development and early integration in the project. Bond-Barnard et al. (2018) describe trust developed, from such other settings as prior experiences, as 'imported trust'. Negative prior experiences, however, will also have contrary effects that further inhibit integrative work practices.

'Project performance' heads the list with a mean score of 4.55, followed by 'decision-making capability' with a similar mean value but a larger standard deviation. The other three leading outcomes are 'problem-solving ability' (mean=4.496), 'team productivity' (mean=4.455), and 'project success' (mean=4.372).

[Please insert Table 4 here]

According to Delarue et al. (2008), teamwork is influenced by the attitudes and behaviours of personnel and has a significant impact on such organisational outcomes as quality, productivity, innovation, and flexibility. However, such contextual factors as organisational and environmental dynamics act to moderate the link between teamwork and organisational performance. Against this background, team development seems to be correlated with the quality of working life (Kuipers and de Witte 2005). Based upon Hut and Molleman's (1998) four-stage team development model that includes job enlargement, job enrichment, teamwork, and developmental learning boundary management, Kuipers and de Witte (2005) conclude that individual empowerment stimulates job satisfaction and involvement among personnel in a conducive working environment.

The knowledgebase is broadened through joint problem solving, which ensures high performance and high-quality decision making (Chow et al. 2005). To solve problems, team members need to have shared mental models of the nature of the problem, group structure, roles, goals, and processes (Levi 2016). Against this background, cooperation and high performance are precursors for greater quality, effective work coordination, and improved productivity, all of which contribute toward enhanced project outcomes. As such, team-oriented management can result in energised, highly motivated personnel that drive productivity and lead to excellence in construction (Spatz 2000).

### ***Ranking of Team Effectiveness Attributes***

As part of the analysis, Cronbach's  $\alpha$  for the 25 attributes evaluated is 0.919, which also satisfies Hair et al.'s (2010) scale reliability criterion of 0.70. Thus, the measurement adopted for team effectiveness is deemed reliable. It is worth noting that Papadopoulos et al. (2012) elucidate that when the Cronbach's  $\alpha$  is greater than 0.60, the variables have high agreement

and are highly correlated. Based on the five-point effectiveness scale, the mean scores and standard deviations are used to prioritise the teamwork attributes. Ranked in descending order of means, Table 5 also provides the overall standard deviation and ranking as well as according to the three company sizes. Overall, the mean scores range from 3.785 to 4.736. The five most significant attributes are 'effective communication among project team members' (mean=4.736), 'efficient team leadership' (mean=4.595), 'well-defined team responsibilities and roles' (mean=4.446), 'clear team goals and objectives' (mean=4.405), and 'good collaboration between all project leaders' (mean=4.355). On the other hand, the two attributes with mean scores below 4.000 are 'interdependency' and 'creativity and innovation'.

[Please insert Table 5 here]

Social interdependence theory suggests that social skills play an important role in enhancing collaboration and resolving conflicts (Tarricone and Luca 2002). Positive interdependence results in both individual accountability and promotive interaction. Thus, a team with high interdependence overcomes difficulties through shared decision-making and problem solving (Harris and Harris 1996). In this connection, active project communications, effective leadership, and clear team roles guide teams to focus on attaining their common goals in a cooperative working environment instead of individualised, competitive settings. These are consistent with Johnson et al.'s (2000) assertion that teamwork entails members using their decision-making, trust-building, communication, and conflict management skills in responding to unpredictable events.

Specific to the construction industry, interactions involving two-way communications with feedback are necessary for performing project activities (Dainty et al. 2006; Rwelamila 1994). In Malaysia, Mohamad et al.'s (2014) evaluation of the collaborative teamwork environment



in the construction industry reported the heavy reliance on such conventional practices as face-to-face meetings and telephone discussions. Likewise, a similar observation is also reported by Yap and Lock (2017) on the preferred use of traditional communication techniques for information exchange among the related parties. Given the strong association of communication and information sharing with a collaborative environment, notable technological advancements in communication technology should be further leveraged to support teamwork communication and enhance cross-functionality in projects (Mohamad et al. 2014). Chow et al.'s (2005) empirical study involving 57 Singapore practitioners found that effective teamwork is highly correlated with trust and coherence, clarity of objectives, passion, and interdependency. In another study in Hong Kong, Fong and Lung's (2007) also conclude that team orientation is positively associated with contractual trust, competence trust, and task interdependence. In Norway, for a building design team to be efficient, the three key pillars comprise collaborative leadership across all disciplines, defining and assigning the specific tasks and duties for each member, and building trust and credibility within the team (Svalesstuen et al. 2015).

Such cultural dimensions of project management as goal alignment and reliance, commitment, cooperative orientation, empowerment orientation, and worker orientation are observed to contribute to the sustainability and success of construction projects (Nguyen and Watanabe 2017). Harmonising team communication is a fundamental aspect of team performance, whereby unsuccessful communication results in loss of time and money, lower efficiency, and can generate unwarranted stress and pressure between team members (Khoury 2019). For example, project meetings provide a good platform to exchange information, discuss difficulties, and explore alternative solutions (Rwelamila 1994).

Further, the Kruskal-Wallis rank-based nonparametric ANOVA is used to determine whether there are statistically significant differences in perceptions between the respondents from the three different company size categories. This shows that 'clear team goals and objectives', 'commitment to the project', 'adequate resources', 'team or task processes', and 'creativity and innovation' vary according to company size. In respect of the ranking, 'commitment to project' and 'adequate resources' are regarded as less significant by those in small firms compared to medium and large organisations; inferring that small businesses with a leaner structure are more nimble than larger ones, where the personnel are self-motivated, have hands-on experience, and participate more actively in projects. The other three attributes are almost comparable in terms of ranking but have some significant differences in their mean values.

### ***Exploratory Factor Analysis of Teamwork Attributes***

Factor analysis is a powerful statistical technique to uncover the underlying factors that explain correlations between several seemingly unrelated variables (Doloi et al. 2012). The Kaiser-Meyer-Olkin (KMO) is 0.841, larger than 0.50, indicating the sample is acceptable for factor analysis (Field 2013). In addition, Bartlett's significance of 0.000 indicates that the population correlation matrix is not an identity matrix and the variables are amply intercorrelated with homogeneous variances.

Using principal component analysis with varimax orthogonal rotation and eigenvalues greater than 1.0 generates six latent constructs, representing the dimensions of teamwork, which account for 62.26% of the total variance explained – greater than the minimum explained variance of 60% needed for a satisfactory factor analysis (Hair et al. 2010; Yap et al. 2019a).

Factor rotation is applied to provide an increased understanding of the factor-loading matrix where the factor loadings are also sorted in descending order. Table 6 presents the final rotated component matrix. All 25 variables have loadings exceeding 0.40, indicating the variables have reasonable communalities. Cronbach's  $\alpha$  ranges from 0.634 to 0.863, demonstrating that each extracted factor is internally consistent (Deng et al. 2018; Papadopoulos et al. 2012). Each dimension is interpreted and named by relating and combining the meanings of the variables with the highest cross-factor loadings (Doloi 2009; Hair et al. 2010). Accordingly, the six manifested dimensions are determined to be Dimension 1: Participative engagement and task commitment; Dimension 2: Team responsibility structure and accountability; Dimension 3: Culture of trust and respect; Dimension 4: Leader's skills and abilities; Dimension 5: Top management support; and Dimension 6: Synergic working environment.

[Please insert Table 6 here]

The average mean scores of each dimension's attributes are also calculated and depicted in Figure 1. It is worth mentioning that all five dimensions attain mean scores of above 4.000, indicating that these dimensions are significant identifiers of team effectiveness in the construction industry. Mohamad et al. (2014) opine that teamwork in construction is influenced by organisational structure, information sharing, collocation, communication, contractual approach, leadership, and cross-functions. In a separate study in Malaysia, Shafie and Samari (2014) consider the characteristics of well-functioning teams to include mind, open communications, commitment to a common purpose and performance goals, shared responsibility, use of resources and talents, capacity for self-evaluation, and participative leadership. In Ghana, the factors boosting team efficiency relate to leadership, communication, trust, description of roles and responsibilities, and working relationships between team

members (Kwofie et al. 2015). In Saudi Arabia, the teamwork factors that significantly influence project success are team roles and responsibilities, team goals and objectives, and team leadership (Assaf et al. 2014). More recently, Faris et al.'s (2019) factor analysis of 23 collaboration traits using survey data obtained from the Kurdistan region in Iraq identifies six principal factors of project vision, participant behaviour, communication, relationship definition, contractual agreements and systematic process. The present study therefore expands the understanding of existing knowledge with new evidence from Malaysia in relation to the key components of effective teamwork for construction projects in the developing world.

[Please insert Figure 1 here]

## **Underlying Dimensions for Team Effectiveness in Construction**

### ***Dimension 1: Participative engagement and task commitment***

This first dimension has the largest total variance of 15.36%, explaining the nine most important attributes with regard to participative management in team building. The leading attribute (with a factor loading of 0.705) that contributes to work-group commitment is ‘actively participates in the team task’, found to be critical for the successful accomplishment of group tasks and roles. As highlighted by Buvik and Rolfsen (2015), responsibility ambiguity and role conflict can cause the team to fail while, given that construction projects have a strong dependency between each discipline, no one person can complete the task without collaborating with others. Then again, role conflict often splits teams and is widespread in construction projects (Kwofie et al. 2015). Moreover, group problem solving and collective effort is more likely to encourage a culture of creativity and high-performance by engaging the knowledge, experience, and skills of multiple team members to accomplish results more efficiently and effectively (Chow et al. 2005). For example, brainstorming can be employed to

stimulate more ideas and encourage group creativity (Levi 2016). Cross-functional teamwork enables members to share information and integrate their knowledge, expertise, and skills to solve practical problems (Buvik and Rolfsen 2015). Further, open collaboration in an effective team stimulates the sharing of ideas and sparks creativity that leads to improved decision making (Spatz 2000). In this connection, the ability to resolve conflict and reach a consensus can greatly contribute to the success of the team (Tarricone and Luca 2002). Additionally, effective teamwork provides self-correction of weaknesses and shortcomings in regulating team performance (Mcewan et al. 2017); for example, senior and experienced members can provide guidance, mentoring, and coaching to less experienced members to reach collective objectives and expectations.

The processes of learning, doing, and participation at work are richly intertwined and interdependent (Billett et al. 2004); hence, workplace participatory practices guide how members can ‘learn by doing’ the work activities which situationally constitute vocational knowledge. According to Dexter (2010), the determinants for developmental team projects are related to people, tasks, processes, locations, and facilities. Competence is also positively linked to team orientation (Fong and Lung 2007); project success is then influenced by each member’s competence in delivering its professional role. In addition, participation in decision making improves group learning, job satisfaction, and group commitment (Saha and Kumar 2017).

### ***Dimension 2: Team responsibility structure and accountability***

This dimension accounts for the second-largest variation of 11.39% and contains six teamwork attributes that explain the criticality of mutual accountability and ownership in developing and sustaining a high-performance construction project-delivery team. ‘Continuous monitoring and

evaluation of the project team’, ‘clear team goals and objectives’, ‘clearly defined project team structure, identity, culture and values’, ‘well-defined team responsibilities and roles’, ‘adequate resources’, and ‘sound knowledge of the management concept of the project’ created this dimension with factor loadings ranging from 0.428 to 0.737. The team members share responsibility, authority, and resources for project completion (Chow et al. 2005); thus, establishing the ‘what, how, when, and who’ is crucial for team members to understand their assignments and responsibilities. According to Doorewaard et al. (2002), the members in a “shared-responsibility team” are accountable for the work preparation, support, and control. On the other hand, decisions are taken by the team leaders in a “hierarchical team”. However, according to Santos and Powell (2001), sharing responsibility for improvement is limited at the Brazilian and English construction sites.

Goal setting and role clarity help minimise fears, confusion, and uncertainties (Levi 2016; Nguyen and Watanabe 2017). Buvik and Rolfsen (2015) assert that trust development and a sense cohesiveness – a major determinant of commitment – is positively influenced by the clarification of roles and expectations. In this respect, the members’ acceptance of the goals and values of the project influence teamwork quality (Bond-Barnard et al. 2018). Nevertheless, adequate resource allocation is needed before the project team can function efficiently (McComb et al. 2008). Therefore, continuous monitoring of team conditions is necessary to ensure the members adjust their workflows and rectify shortcomings that affect team effectiveness (Choi 2002). Teams need to learn how to be more flexible and adaptable to rapid changes; reflexivity requires taking time out to reflect on how the team is going and develop strategies for improvement (Levi 2016).

### ***Dimension 3: Culture of trust and respect***

The third dimension accounts for 10.01% of the total variance explained, which underscores the relevance of a supportive culture of credibility to deepen teamwork. This dimension is created by a ‘sound relationship between team members’, ‘mutual trust between team members’, and ‘respect between team members’, all with a factor loading exceeding 0.600. Team identity is created when individuals set aside their differences and develop into a single unit with a common culture, which includes group attitudes, climate, customs, and norms (Franz et al. 2016). The perceived trustworthiness between team members increases when they are aligned with similar values and outlooks (Buvik and Rolfsen 2015). In this respect, group identity boosts morale and the sense of unity that supports the collective understanding of project goals (Harris and Harris 1996). On the other hand, the absence of trust causes people to hoard information and work in silos, which can ultimately lead to a dysfunctional team (Kwofie et al. 2015).

Collective strength is built upon the principles of trust, mutual respect, and cooperation toward the achievement of a common goal (Fong and Lung 2007). As such, trust between team members is linked with honesty, transparency, consistency, and respect (Svalesstuen et al. 2015). In a trusting relationship, adversarial attacks and blaming games can be circumvented, resulting in greater psychological health and self-esteem (Johnson et al. 2000). Members are more caring and committed to positive peer relationships, which typically results in higher achievement and greater productivity (Tarricone and Luca 2002). In essence, a trust-based collaborative environment facilitates successful project delivery (Bond-Barnard et al. 2018).

#### ***Dimension 4: Leader's skills and abilities***

'Good collaboration between all project leaders' (0.686 factor loading) and 'team leaders power and authority' (0.598 factor loading) create this fourth dimension, with a total variance of 8.86% explaining the significance of leadership competencies and skills related to team management. Both attributes attain factor loadings greater than 0.50, indicating good communalities (Yap et al. 2019a). Project leaders need to cultivate charismatic and participative skills, as these leadership behaviours can significantly increase the level of satisfaction of the team, which can substantially improve team performance (Cheung et al. 2001). 'Participative' leaders actively engage with team members through appropriate delegation, encourage constructive conflict, and value feedback through open discussion and constructive participation (Cheung et al. 2001). The practice of participative management and shared leadership tends to decrease competition between team members but increase cooperation (Spatz 2000).

Desirable transformational leadership behaviours include being charismatic, inspirational, intellectually stimulating, and considerate (Cheung et al. 2001). The leader's competency to deliver optimum achievement of the team goals is also important (Baiden and Price 2011); however, the lack of direct contractual relationships in a temporary project team can make the line of authority subtle. A competent team leader helps enrich project communications and mutual understanding to complete the tasks required (Cheung et al. 2001). Empowered team leaders can achieve high performance (McComb et al. 2008), while in the Ghanaian construction industry for instance, efficient team leadership is found to contribute to merely 30% of project team effectiveness (Kwofie et al. 2015).



### ***Dimension 5: Top management support***

The fifth dimension extracted with total variance of 8.51% explains the significance of senior management commitment in the context of three important attributes: ‘top management involvement’, ‘effective team leadership’, and ‘effective communication between project team members’, with factor loadings of 0.723, 0.649, and 0.619 respectively. Strong support from the top management of each project team from the client, consultant and contractor sides are well known to be needed for a collaborative teamwork environment in the construction industry (Mohamad et al. 2014). Top management support is observed by McComb et al. (2008) to significantly increase the motivation and performance of team members; conversely, the lack of top management support can result in inadequate resources and therefore be a constraint on team productivity. Creating a teamwork culture is easier when teamwork is promoted, sponsored, and supported from the top. Thus, project efficiency is stronger when top management is involved (McComb et al. 2008).

Active communication and supportive behaviour are central to ensure the right information gets to the appropriate person at the right time (Baiden and Price 2011). Any improvement in information flow would likely improve project performance (Cheung et al. 2013). Communication flaws and ineffectiveness can result in such multiple adverse consequences as time-cost overruns, frequent changes, and rework (Kwofie et al. 2015; Yap et al. 2018). Major communication problems in megaprojects in China, for instance, are poor communication mechanisms, weak team structures, unavailability of standard operating procedures (SOP) for construction information, and lack of advanced information and communication technologies (Tai et al. 2009). To improve communication, construction project teams need to have project-level communication processes that involve stakeholder identification, communication planning, information distribution, stakeholder management, and performance reporting along

with engaging appropriate project management tools and techniques (Senaratne and Ruwanpura 2016).

### ***Dimension 6: Synergic working environment***

The sixth dimension accounts for 8.13% of the total variance explained, consisting of two distinct attributes signifying team members' attitudes in engaging a collaborative culture. This dimension is created by 'interdependency' (0.833 factor loading) and 'team cohesiveness' (0.601 factor loading). Members of temporary construction project teams need to interrelate to bring a project to completion by integrating the knowledge, expertise, and skills that are distributed between professionals with differing degrees of expertise, skills, and experiences (Buvik and Rolfsen 2015). For this reason, cross-functional collaboration is helpful for sharing knowledge and information between team members (Eriksson et al. 2017; Yap et al. 2018). There is a sense of mutuality with regard to goals, benefits, obligations, and efforts (Chow et al. 2005).

According to Franz et al. (2016), group cohesiveness is directly associated with the team's goal commitment, team chemistry, and timeliness of communication, their structural equation model indicating that improvements in group cohesion help reduce project cost growth, improve facility quality, and increase customer satisfaction. Given a high level of motivation, a cohesive team can work together to persevere with problems and setbacks to achieve common goals (Tarricone and Luca 2002).

## Conclusions

Despite the importance of the team-based approach having increased in recent years with the growing trend towards partnership and integrated project delivery in the global construction industry (Chan et al. 2004; Hughes et al. 2012), the underachievement of the global construction industry because of poor teamwork between project participants continues to attract considerable criticism. The high level of fragmentation, as well as lack of coordination and cooperation within the product delivery process, hinders the formation of effective teams, which in turn results in inefficiencies and ineffectiveness in project management. Collaborative working has a significant impact on project success. Despite a number of team-based studies in general project management, relatively little is known of the roles, factors, and dimensions of team effectiveness in construction – indicating significant knowledge gaps, particularly in the developing world where the performance of the construction industry is a major determinant of socio-economic growth. To fill the gap in existing theoretical knowledge, the present study investigates the aspects and attributes of teamwork that are relevant to the delivery of construction projects. Following a detailed literature review, a survey questionnaire employed to solicit 121 opinions from construction practitioners in Malaysia comprising representatives from client, consultant, and contractor organisations.

The first objective was to identify and rank the aspects of teamwork in a project-based construction setting. The one-sample *t*-test revealed that all the 10 aspects identified are perceived to be significant. The most critical of these are ‘project performance’, ‘decision-making capability’, and ‘problem-solving ability’. The second objective was to examine the critical attributes affecting team effectiveness in construction. From the mean scores, the most influential attributes are ‘effective communication between project team members’, ‘efficient team leadership’, ‘well-defined team responsibilities and roles’, ‘clear team goals and

objectives', and 'good collaboration between all project leaders'. The third objective was to assess the degree of agreement on the ranking of the attributes based on company size. The Kruskal-Wallis ANOVA indicates that five attributes have statistically significant differences with respect to company size, namely 'clear team goals and objectives', 'commitment to the project', 'adequate resources', 'team or task processes', and 'creativity and innovation'. The fourth objective was to uncover the underlying dimensions of these attributes using factor analysis. The exploratory factor analysis revealed six underlying dimensions: namely, (1) participative engagement and task commitment, (2) team responsibility structure and accountability, (3) a culture of trust and respect, (4) leader's skills and abilities, (5) top management support, and (6) synergic working environment. These dimensions of team effectiveness draw on the project-based environment and team dynamics in project delivery and management in construction. Consequently, these findings make a significant contribution to streamlining collaboration and improving teamwork quality. To this end, a theoretical contribution of the investigation is to provide statistical support for both academics and practitioners to gain an increased understanding of the dimensionality of teamwork attributes in the context of the developing world.

The findings of this study also have practical implications. Given that such critical inhibitors of the time and cost control of construction projects as design changes, rework, conflicts and ineffective communication are significantly associated with poor teamwork (Shafie and Samari 2014; Yap et al. 2017), a collaborative culture is needed as a contributing factor for enhancing project performance and managing projects successfully. The uncovered teamwork dimensions serve as effectiveness indicators and are anticipated to guide organisations in devising policies and processes to building and sustaining effective teams and individual excellence. The study is also useful for construction practitioners who work in team-based settings, to enlarge their understanding of how project teams function so they can become more effective team leaders

and members – to be engaged and to perform using their expertise. Project managers will have training, development, and leadership goals while team members are aware of what is expected of them. By taking cognisance of the aspects of teamwork in construction and the attributes that determine team effectiveness, project outcomes could be improved with team development.

To improve project delivery, the project team needs to work closely to focus on strengths and support weaknesses, allowing the benefits of teamwork to be fully realised. The findings also offer some valuable insights for teaching and learning in higher education, as well as the training curricula of construction professionals, with regard to issues that can influence team integration and managerial efficiencies. Finally, further research is recommended to establish effective team building processes and collaboration tools for working effectively and fostering teamwork involving dissimilar professional practitioners at different stages of project delivery. This should be of great help in ensuring a more productive and successful whole project team.

Notwithstanding the interesting findings of the study, there are limitations in that the quantitative data collection tool using a self-completion questionnaire is designed to collect standardised data and does not allow further probing to generate further explanation from construction practitioners such as in qualitative interviews. Further studies using qualitative approaches such as the process of observation and case study research are therefore needed for in-depth explorations. The study also did not examine cultural diversity in multinational construction organisations, which may affect teamwork in different ways and levels. To overcome this issue, future research should collate different measures spread over Western and Eastern cultures for a cross-cultural comparative analysis, as international joint ventures are gaining traction in construction projects globally.

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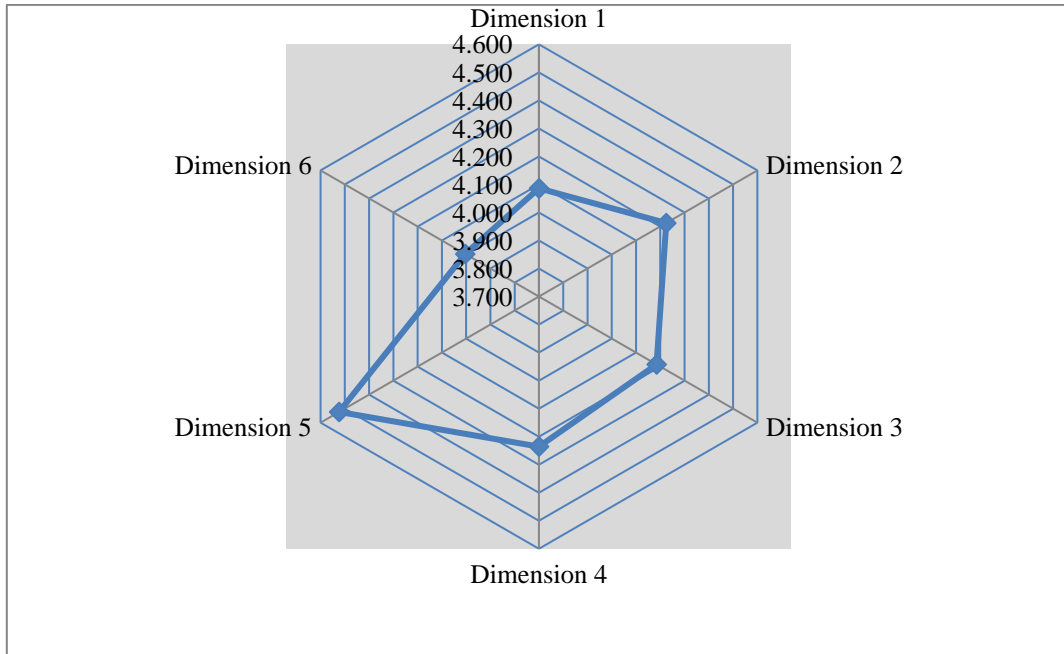
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**Figure 1.** Significance scores of dimensions of team effectiveness

**Table 1.** Aspects of teamwork in construction

Ref.	Aspect	Reference						Total
		(Kwofie et al. 2015)	(McComb et al. 2008)	(Assaf et al. 2014)	(Chow et al. 2005)	(Latif and Williams 2017)	(Baiden and Price 2011)	
R1	Team performance	×	×	×	×	×	×	6
R2	Project success	×	×	×	×	×	×	6
R3	Goal attainment or achievement	×	×		×	×	×	5
R4	Project performance		×	×		×	×	4
R5	Team productivity	×			×	×	×	4
R6	Team satisfaction	×	×		×		×	4
R7	Decision-making				×	×	×	3
R8	Client satisfaction	×		×				2
R9	Problem-solving	×			×			2
R10	Preparation for the future			×				1

**Table 2.** Attributes influencing team effectiveness

Ref.	Attribute	Reference									Total
		(Essens et al. 2005)	(Chow et al. 2005)	(Svalesstuen et al. 2015)	(Assaf et al. 2014)	(Baiden and Price 2011)	(Latif and Williams 2017)	(Azmy 2012)	(McComb et al. 2008)	(Kwofie et al. 2015)	
A1	Clear team goals and objectives	×	×	×	×	×	×	×	×		8
A2	Well-defined team responsibilities and roles	×		×	×	×	×	×		×	7
A3	Mutual trust between team members	×	×	×	×	×		×		×	7
A4	Effective communication between team members	×		×	×	×		×		×	6
A5	Sound relationships between team members			×	×	×	×	×		×	6
A6	Efficient team leadership	×			×		×	×		×	5
A7	Team cohesiveness	×	×	×			×				4
A8	Respect between team members	×	×				×				3
A9	Clearly defined team structure, identity, culture, and values	×				×	×				3
A10	Actively participate in the team tasks		×			×	×				3
A11	Sound knowledge of the management concept of the project	×				×	×				3
A12	Top management involvement							×	×		2
A13	Continuous monitoring and evaluation of the team	×						×			2
A14	Interdependency		×				×				2
A15	Enthusiastic attitude to project success		×				×				2
A16	Reach consensus on issues					×	×				2
A17	Shared ideas and views between team members					×	×				2
A18	Team leaders power and authority						×		×		2
A19	Focus on team development			×			×				2
A20	Commitment to the project			×		×					2
A21	Teams' ability to adapt and respond to change	×									1
A22	Adequate resources								×		1
A23	Good collaboration between all project leaders			×							1
A24	Creativity and innovation							×			1
A25	Team/task processes							×			1



**Table 3.** Demographic profile of respondents

Personal profile	Categories	Frequency	Percentage (%)
Company type	Client/Developer	21	17.4
	Consultant	29	24.0
	Contractor	71	58.7
Age (years old)	Below 20	3	2.5
	20 to 29	69	57.0
	30 to 39	37	30.6
	40 to 49	9	7.4
	50 and above	3	2.5
Education background	Doctorate	1	0.8
	Master	12	9.9
	Bachelor	102	84.3
	Diploma	5	4.1
Working experience (years)	High School	1	0.8
	0 to 5	73	60.3
	6 to 10	16	13.2
	11 to 15	18	14.9
	16 to 20	7	5.8
Company size (number of employees)	Over 20	7	5.8
	1 to 50	38	31.4
	51 to 200	33	27.3
	201 and above	50	41.3
Major procurement type used	Traditional	55	45.5
	Design and build	38	31.4
	Management constructing	4	3.3
	Construction management	24	19.8

**Table 4.** Result of one sample *t*-test for aspects of teamwork in construction

Ref.	Aspect	Test value = 3				
		Rank	Mean	<i>t</i> -Value	Std. Deviation	Sig (2-tailed)
R4	Project performance	1	4.504	27.885	0.593	0.000**
R7	Decision-making	2	4.504	27.247	0.607	0.000**
R9	Problem-solving	3	4.496	28.412	0.579	0.000**
R5	Team productivity	4	4.455	27.713	0.577	0.000**
R2	Project success	5	4.372	26.052	0.579	0.000**
R1	Team performance	6	4.289	22.222	0.638	0.000**
R3	Goal attainment or achievement	7	4.248	25.579	0.537	0.000**
R8	Client satisfaction	8	4.124	14.854	0.832	0.000**
R6	Team satisfaction	9	4.074	14.444	0.818	0.000**
R10	Preparation for the future	10	3.917	12.583	0.802	0.000**

Note: \*\* The mean difference is significant at the 0.01 level of significance.

**Table 5.** Importance ranking on the factors affecting team effectiveness according to company size

Ref.	Attributes	Company size									Overall (N=121)			Kruskal-Wallis	
		1 to 50 employees (N =38)			51 to 200 employees (N=33)			≥ 201 employees (N=50)							
		Mean	SD	Rank	Mean	SD	Rank	Mean	SD	Rank	Mean	SD	Rank	Chi-square Value	Asymp. Sig.
A4	Effective communication between team members	4.605	0.638	1	4.758	0.502	1	4.820	0.388	1	4.736	0.513	1	3.362	0.186
A6	Efficient team leadership	4.579	0.500	2	4.606	0.609	2	4.600	0.495	2	4.595	0.526	2	0.296	0.862
A2	Well-defined team responsibilities and roles	4.316	0.662	4	4.424	0.663	4	4.560	0.577	4	4.446	0.632	3	3.174	0.205
A1	Clear team goals and objectives	4.184	0.692	5	4.424	0.561	3	4.560	0.541	3	4.405	0.613	4	7.030	0.030*
A23	Good collaboration between all project leaders	4.447	0.555	3	4.364	0.653	6	4.280	0.784	11	4.355	0.681	5	0.570	0.752
A8	Respect between team members	4.158	0.789	7	4.242	0.751	8	4.480	0.614	5	4.314	0.719	6	4.072	0.131
A20	Commitment to the project	4.026	0.822	14	4.394	0.659	5	4.420	0.702	6	4.289	0.747	7	6.515	0.038*
A12	Top management involvement	4.158	0.718	6	4.272	0.674	7	4.280	0.757	10	4.240	0.719	8	0.861	0.650
A3	Mutual trust between team members	4.053	0.899	12	4.061	0.827	17	4.300	0.614	8	4.157	0.775	9	2.001	0.368
A22	Adequate resources	3.895	0.863	21	4.152	0.834	13	4.360	0.722	7	4.157	0.817	10	6.728	0.035*
A13	Continuous monitoring and evaluation of the team	4.026	0.753	13	4.121	0.545	14	4.260	0.664	13	4.149	0.667	11	2.899	0.235
A15	Enthusiastic attitude to project success	4.105	0.764	9	4.030	0.810	19	4.240	0.591	15	4.141	0.711	12	1.434	0.488
A10	Actively participate in team tasks	3.921	0.941	20	4.182	0.683	9	4.280	0.671	9	4.141	0.778	13	3.000	0.223
A21	Team's ability to adapt and respond to change	3.947	0.733	18	4.152	0.566	11	4.260	0.664	13	4.132	0.670	14	4.089	0.129
A11	Sound knowledge of management concept of the project	3.947	0.655	17	4.182	0.727	10	4.200	0.670	18	4.116	0.685	15	3.448	0.178
A18	Team leaders' power and authority	4.132	0.665	8	4.152	0.755	12	4.080	0.724	24	4.116	0.709	16	0.182	0.913
A17	Shared ideas and views between team members	3.895	0.953	22	4.121	0.781	15	4.240	0.625	16	4.099	0.790	17	2.716	0.257

A5	Sound relationships between the team members	3.842	0.855	23	4.091	0.843	16	4.260	0.565	12	4.083	0.759	18	4.938	0.085
A16	Reach consensus on issues	4.079	0.749	10	3.909	0.522	24	4.180	0.720	20	4.074	0.685	19	3.646	0.162
A9	Clearly defined project team structure, identity, culture, and values	3.947	0.837	19	4.030	0.684	18	4.200	0.670	18	4.074	0.732	20	2.680	0.262
A19	Focus on team development	4.000	0.870	15	4.000	0.661	21	4.180	0.800	21	4.074	0.787	21	2.048	0.359
A7	Team cohesiveness	3.974	0.753	16	4.000	0.707	23	4.120	0.594	23	4.041	0.676	22	0.951	0.622
A25	Team or task processes	3.816	0.896	24	4.000	0.559	20	4.240	0.625	16	4.041	0.723	23	6.150	0.046*
A14	Interdependency	4.053	0.804	11	4.000	0.661	21	3.880	0.773	25	3.967	0.752	24	1.459	0.482
A24	Creativity and innovation	3.316	0.842	25	3.727	0.761	25	4.180	0.800	21	3.785	0.878	25	20.456	0.000**

**Table 6.** Dimensions of team effectiveness in construction

Details of underlying dimensions	Factor loading	Variance explained (%)	Cronbach $\alpha$
<i>Dimension 1: Participative engagement and task commitment</i>		15.36	0.863
A10	Actively participate in the team tasks	0.705	
A20	Commitment to the project	0.654	
A25	Team/task processes	0.628	
A24	Creativity and innovation	0.614	
A17	Shared ideas and views between team members	0.612	
A16	Reach consensus on issues	0.549	
A19	Focus on team development	0.529	
A15	Enthusiastic attitude to project success	0.497	
A21	Team's ability to adapt and respond to change	0.404	
<i>Dimension 2: Team responsibility structure and accountability</i>		11.39	0.787
A13	Continuous monitoring and evaluation of the team	0.737	
A1	Clear team goals and objectives	0.650	
A9	Clearly defined project team structure, identity, culture, and values	0.642	
A2	Well-defined team responsibilities and roles	0.475	
A22	Adequate resources	0.475	
A11	Sound knowledge of the management concept of the project	0.428	
<i>Dimension 3: Culture of trust and respect</i>		10.01	0.730
A5	Sound relationships between team members	0.784	
A3	Mutual trust between team members	0.753	
A8	Respect between team members	0.614	
<i>Dimension 4: Leader's skills and abilities</i>		8.86	0.667
A23	Good collaboration between all project leaders	0.686	
A18	Team leaders' power and authority	0.598	
<i>Dimension 5: Top management support</i>		8.51	0.634
A12	Top management involvement	0.723	
A6	Efficient team leadership	0.649	
A4	Effective communication between project team members	0.619	
<i>Dimension 6: Synergic working environment</i>		8.13	0.702
A14	Interdependency	0.833	
A7	Team cohesiveness	0.601	
Cumulative variance explained		62.26	0.919
Kaiser-Meyer-Olkin measure of sampling adequacy		0.841	
Bartlett's test of sphericity Approx. $\chi^2$		1348.684	
df		300	
Sig.		0.000	

Note: Only loadings of 0.4 or above are shown. Extraction method = Principal component analysis; rotation method = Varimax with Kaiser normalisation. Rotation converged in 9 iterations.