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# Developing attributes for evaluating construction project-based performance

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## Abstract

**Purpose** – The Indonesian construction industry has to considerably rise due to the issues of quality product, organisational performance and global competitiveness faced today, along with settling several national challenges that continue to plague the construction industry. Delivering high-quality construction products and services is non-negotiable when competing for contracts with international constructors. Developing such an assessment system to evaluate the performance of Indonesian construction companies is an urgent need in order to encourage and motivate the construction companies to continually improve their performance in the execution of construction works. The purpose of this paper is to empirically test the key attributes related to the evaluation of quality and performance in the construction project-based case of Indonesia.

**Design/methodology/approach** – A survey was conducted in the five provinces in Indonesia involving 216 construction practitioners from medium and large qualifications of construction companies.

**Findings** – On the basis of the data analysis results, the study develops the 39 key attributes that can be a basis for the development of Indonesian building construction project performance assessment system. The attributes cover construction companies' performance during project implementation, in delivering final project results and in implementing quality procedures for building construction works.

**Originality/value** – The outcome of this study is considered significant to provide a tool for the government to assess the quality performance of contractors in delivering projects against specified standards, and a guideline for the contractors to improve their competitiveness by implementing continuous quality improvement. The confirmed attributes developed from this study is an initial step towards developing an Indonesian construction comprehensive quality performance assessment system.

**Keywords** Construction project, Quality assessment, Performance attributes

**Paper type** Research paper

## 1. Introduction

Construction project activity in Indonesia has increased significantly in recent years, reflecting the combination of government financing for infrastructure facilities and private sector investment in housing and property development. Indonesia, is categorised as one of the emerging markets in the Asia Pacific Region, and is one of the seven countries (the others being China, India, USA, Canada, Russia and Australia), that it is predicted to account for 65 per cent of growth in global construction by 2020 (Betts *et al.*, 2011).

Given the emerging prospects of the Indonesian construction industry to become the "engine" of national economic development, Indonesian construction companies are still unfortunately plagued by low competitiveness (Pamulu, 2010) and global contract performance (Willar *et al.*, 2015). The lack of competitiveness of domestic contractors when competing for contracts with foreign companies, both at national and international levels, is mainly attributed to the lack of success of their development strategy and policy (Budiwibowo *et al.*, 2009) as well as their inconsistency in implementing quality systems (Willar, 2012). These challenges and constraints have resulted in the inability of many Indonesian contractors to capitalise on development and contractual opportunities due to their incapability of attaining higher levels of performance (Pamulu, 2010). At the same time, there has in recent years been a significant increase in the number of foreign companies competing for contractual opportunities in Indonesia, while a very small number of large-scale Indonesian contractors are operating in an international market (Widjajanto *et al.*, 2011).

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In order to embrace the issue of "quality and performance" of the Indonesian construction industry, the Indonesian government has enacted regulations and policies for construction companies undertaking projects, particularly those that are government related. The regulations and policies set by the government are mainly in terms of the development and implementation of a quality management system (QMS), based on QMS ISO 9001. However, after implementing those regulations and policies, for over a decade, there is still a lack of deep-rooted operational practices and procedures needed for ensuring the ultimate delivery of a well-operated QMS capable of giving customer satisfaction in line with the espoused values of ISO 9001.

Information obtained from the preliminary study, on March 2, 2015, i.e. the interviews with the officers from the National Construction Services Development Board (NCSDB), Directorate General of Construction Development (DGCD) of the Ministry of Public Works and Housing and with practitioners from the Indonesian Contractors Association and National Contractors Association of Indonesia, regarding the leading role of the government and the current regulation concerning Indonesian construction quality system, suggested that there is a lack of monitoring and evaluation of the implementation of the quality and quality system related regulations and policies within the Indonesian construction service providers. For example, there is a government mandate for the contractors to develop a quality plan of contract implementation (RMK) as an assurance that the Ministry of Public Works and Housing's projects will be undertaken in accordance with the content of the contract. However, the RMK has been prepared solely based on a desire to be included in the government tendering lists projects, without having been fully referenced by both the government officer and the contractors. Following this case, regarding the measurement of contractors' performance, there is a need of a system to measure the performance of contractors in the project level and in the organisational level, which, in turn, will be used to evaluate the performance of the construction industry.

The availability of quality assessment and performance systems of construction companies in some countries has been proven effective in significantly improving the quality of the construction work, which in turn allows the contractors to have high business competitiveness in the world construction market. For examples, the Performance Assessment Scoring System (PASS) manual possessed by the Hong Kong Housing Authority has proven to be a highly useful tool for selecting better performing contractors to tender for upcoming projects and to evaluate their performance among other similar service providers (Coffey, 2010). Singapore's Building and Construction Authority (BCA) since 1989 has been using its Construction Quality Assessment System (CONQUAS) to assess the performance of construction companies in producing high quality of project results, by encouraging them to "do things right the first time" while also providing high-work motivation by way of rewards granted in terms of tender opportunities and awards (Building and Construction Authority (BCA), 2005). Meanwhile, Indonesia has not had a similar scoring system; therefore, it is considered necessary to develop the system as a follow-up of the rules and policies that have been established to accommodate the issue of quality, performance and competitiveness of the construction industry. This paper discusses the development of attributes for evaluating Indonesian contractors' quality performance, particularly in construction building projects. The output of the study will be used for further research to develop a construction comprehensive quality performance assessment system in Indonesia.

## 2. Construction quality performance

The results of a survey of quality in construction by the Federation Internationale des Ingenieurs-Conseils has clearly indicated that the failure in construction quality is a problem worldwide (Rumane, 2011). In the light of such reports and also due to the local shortfalls

described before, the government of Indonesia in order for its construction industry to become more competitive has enacted specific regulations relating to the development and implementation of QMSs, acknowledging that quality in construction is a major concern in the global construction industry (Rumane, 2011). The implementation of QMSs has become more widespread in the Indonesian construction industry since the quality of civil engineering project work became an issue of concern to the government, contractors, consultants, project customers and end users. QMSs are becoming increasingly important to customers, who have developed a growing aspiration to engage qualified and professional construction companies, capable of meeting their specification requirements and capable of giving better customer satisfaction. Quality management in the construction industry is different from that of manufacturing or other service industries, as in the construction industry it encompasses not only the quality of products, but also the total management approach to meet a defined purpose provided by clients (Rumane, 2011).

The quality performance of national construction companies will be evidenced by the availability of measuring instruments in accordance with the essential needs of its construction industry and with the continuous quality improvement development of the world construction industry. The quality goal in construction cannot be met in the absence of standards to measure it (Tam *et al.*, 2000). However, there is no single performance measurement system that fits the construction industry. It is therefore an important task for every construction company in individual country to develop a comprehensive performance measurement that can help the construction industry to measure its existing performance, and then decide which performance criteria need to be more improved for the future continuity of the construction company's business life. According to a discussion with the officers from the Ministry of Public Works and Housing, it was confirmed that Indonesian construction companies' performance is proposed to be evaluated and measured based on the project task level and the company level, which eventually will indicate the performance of the construction industry. So far, the quality performance of the Indonesian construction companies is evaluated based on the possession of QMS ISO 9001. However, since the construction industry is project oriented, it is necessary to develop an integrated method to concurrently measure both project performance and company performance (Yu *et al.*, 2007). Looking more deeply into the specific construction quality performance indicators, the following paragraphs describe the reviews on earlier research findings on the issue, which become the basis for the development of the data collection instrument of this research study.

### *2.1 Project task performance*

The uniqueness of every construction project might result in an evaluation of construction performance starting from the project task level. Reviews on literatures have addressed what needs to be met to achieve a successful construction project task performance. Meeting stakeholders' satisfaction through successful completion of overall project performance (time, quality and cost) is a key attribute in developing project performance criteria for construction projects (Zhang and Fan, 2013). The authors have also defined stakeholders' satisfaction as that of all parties who are involved in a project, such as owner's satisfaction, project team's satisfaction, end-user's satisfaction and suppliers' satisfaction. The quality of the construction process and the level of customer satisfaction derived from it need to be operationalised to form a quality performance assessment system (Yasamis *et al.*, 2002), to provide a definite basis for performance measurement, as required by ISO 9001 certified companies. As also noted by Ali and Rahmat (2010), client satisfaction was found to be one of the most important criteria for measuring the Malaysian construction company performance.

In an attempt to define the key performance indicators (KPI) for measuring construction project success, according to Chan and Chan (2004), in addition to the basic KPI on project

success (cost, time and quality), other measures are attracting increasing attention. Strong project commitment and rich project communication are also defined by Andersen *et al.* (2006) as the main contributors of project success; these factors were recommended by Nguyen *et al.* (2004) as a measuring guideline to successfully handle construction projects in Vietnam and other countries especially in the Asian construction industry. Other measures, such as health, safety, environmental friendliness (Lam *et al.*, 2010), user participation and teamwork (Frödell *et al.*, 2008), sustainable building construction (Zabihi *et al.*, 2012), and human-related factors of competence and cooperation (Yong and Mustaffa, 2012) are what the authors define as the most important factors to be considered in achieving building project success. No less importantly, construction project key players' performance (project managers, project team members, employees, supplier's personnel) play an important role in improving project performance (Artto and Arenius, 2000; Powl and Skitmore, 2005; Love *et al.*, 2011; Zhang and Fan, 2013).

On the other hand, some researchers have identified several factors that contribute to unsuccessful projects. Conflict was recognised as a major cause of low performance of Malaysian construction projects (Al-Sibaie *et al.*, 2014). Human-related factors, therefore, according to Zhang and Huo (2015) become important factors in solving interpersonal conflicts in construction projects. Gustavsson and Gohary (2012) show other human-related factors, namely communication, cooperation and integration as major challenges in traditional construction project practice. These critical factors that might cause construction project failure are calculable in defining the research instrument of this research study.

### *2.2 Construction companies' performance*

Although there are many potential criteria, which might be measured to assess construction companies' performance and achievements, the notion that construction companies' performance measured in terms of business or financial performance is still critical, particularly for the Indonesian construction industry, which is focussed on ISO 9001 certified contractors (Asa *et al.*, 2009). Research on the links between quality-based ISO 9001 certified companies and financial performance in various industries has found contradictory results. ISO 9001 certified companies, in addition to improving their operational efficiency, also have improvements in their financial performance (Cow-Chua *et al.*, 2003; Haupt and Whiteman, 2004; Sharma, 2005). Marín and Ruiz-Olalla (2011) also researched this issue and found that there was a positive relationship between ISO 9001 quality certification and business results. However, not all companies that become ISO 9001 certified show financial performance benefits (Naveh and Marcus, 2005; Morris, 2006; Benner and Veloso, 2008). In the construction research area itself, studies on the effects of ISO 9001 implementation on the certified companies' business performance are still limited.

Bassioni *et al.* (2004) addressed the shift of performance measurement in construction companies, from financial considerations to a mixture of both financial and non-financial considerations. Using Korean construction companies as an example, Yu *et al.* (2007) developed an implementation model to measure and compare the performance of construction companies with other construction companies. They proposed a model based on the: financial aspects (profitability, growth, stability); customer aspects (external customer satisfaction, internal customer satisfaction, market share); internal business processes (research and development, technological capability, business efficiency); and learning and growth aspects (human resources development, organisation competency). Some popular frameworks, such as the balanced scorecard model, the European Foundation for Quality Management excellent model and the Construction Best Practice Program-Key Performance Indicators (CBPP-KPI) model, have been adopted and widely used within the construction industry (Yang *et al.*, 2010).

The performance of construction companies eventually lead to the performance of the construction industry. Current research on Indonesian construction industry performance has revealed the eight KPIs of Indonesian largest-scale (G-7) contractors' performance during their QMS ISO 9001 implementation (Willar *et al.*, 2015). The authors found that after almost a decade of QMS implementation in Indonesia, the G-7 contractors' achievements in several key performance areas have not yet been reflected in terms of a very high-performance level. However, despite this, ISO 9001 certified companies have gained some level of esteem in both local and national construction markets and are also making some attempts to provide better quality services and products. Examples from construction industries elsewhere in the world indicate that construction companies have been driven to attain ISO 9001 certification for the purpose of gaining a foothold in non-local markets, and that there is an understanding that this will become obligatory for entry to global markets in the near future (Turk, 2006; Elghamrawy and Shibayama, 2008).

Despite the views noted above, the study by Willar *et al.* (2015) have also indicated a contrary view, with most Indonesian companies seeking ISO 9001 certification not actually possessing aspirations relating to entry into the global construction market. This being said, Indonesian contractors do see obvious potential benefits from adopting and implementing their QMSs, and they also appear ready and enthusiastic to accept and implement QMSs effectively, and this is well underpinned by significant government support. There also exists a strong belief that participating in the global construction market is beneficial to certified contractors. While the previous study has reported the effectiveness of the QMSs being operated in Indonesian construction companies, including the companies' level of performance while implementing their QMSs, this study is a follow-up of the previous studies, which focusses on the development of attributes for evaluating Indonesian contractors' quality performance, particularly in construction building projects. The output of the study is being used for further research projects to develop an Indonesian construction comprehensive quality performance assessment system.

The reviews on previous research findings on construction project-based performance and the performance at the company level provide sources of attributes, which most of the project-based performance attributes, particularly in the construction building project, are adopted as measurement indicators to be proposed in the development of an Indonesian construction quality performance assessment system. A summary of these attributes is shown in Tables I-II, respectively.

| No. | Authors | Performance attributes |
|---|---|---|
| 1 | Zhang and Huo (2015) | Human-related factors |
| 2 | Al-Sibaie *et al.* (2014) | Free of conflict |
| 3 | Zhang and Fan (2013) | Time, quality, cost, owner satisfaction, project team satisfaction, suppliers satisfaction, end-user satisfaction |
| 4 | Yong and Mustaffa (2012) | Human-related factors of competence, cooperation |
| 5 | Gustavsson and Gohary (2012) | Communication, cooperation, integration |
| 6 | Zabihi *et al.* (2012) | Sustainable building construction |
| 7 | Zhang and Fan (2013), Love *et al.* (2011), Powl and Skitmore (2005), Artto and Arenius (2000) | Project managers, project team members, employees, supplier's personnel |
| 8 | Ali and Rahmat (2010) | Customer satisfaction |
| 9 | Lam *et al.* (2010) | Health, safety, environmental friendliness |
| 10 | Frodell *et al.* (2008) | User participation, teamwork |
| 11 | Andersen *et al.* (2006), Nguyen *et al.* (2004) | Strong commitment, rich communication |
| 12 | Chan and Chan (2004) | Cost, time, quality |
| 13 | Yasamis *et al.* (2002) | Construction process, customer satisfaction |

**Table I.**
Various attributes of project task performance

**Table II.**
Various attributes of construction companies' performance

| No. | Authors | Performance attributes |
|---|---|---|
| 1 | Willar *et al.* (2015) | Quality service and product, financial performance, sustainable construction, product innovation and development, employee satisfaction, global contract |
| 2 | Marín and Ruiz-Olalla (2011) | Business performance |
| 3 | Asa *et al.* (2009) | Financial performance |
| 4 | Elghamrawy and Shibayama (2008), Turk (2006) | Global contract |
| 5 | Yu *et al.* (2007) | Financial aspects, customer aspects, internal business processes, learning and growth aspects |
| 6 | Sharma (2005), Haupt and Whiteman (2004), Cow-Chua *et al.* (2003) | Financial performance |
| 7 | Bassioni *et al.* (2004) | A mixture of financial performance and non-financial performance |

### *2.3 Construction performance assessment systems*

The quality goals can be achieved only if there are standards to measure them (Tam *et al.*, 2000). In the case of the Indonesian CONQUAS, QMS ISO 9001 is utilised as the international standard to measure the construction quality performance. This quality standard has become a benchmark for the implementation of good management and process control in a variety of industries and sectors (McCornac, 2006; Tricker, 2008; Fotopoulos *et al.*, 2010; Wahid *et al.*, 2011), which has been particularly widely adopted by the construction industry (Chini and Valdez, 2003; Turk, 2006; Lordsleem *et al.*, 2010; Watson and Howarth, 2011). The ISO 9001 standard is actually a generic one, which can be used successfully in construction companies and on their projects, even though every project is unique and involves different subcontractors and suppliers. In addition to QMS ISO 9001, several countries of the Association of Southeast Asian Nations have developed their own construction performance assessment systems.

Singapore's BCA in 1989 developed the CONQUAS to assess construction service providers for their performance in producing high-quality project results (BCA, 2005). By developing CONQUAS (and its new version CONQUAS 21), the Singapore construction industry has its own quality assessment system, which can enhance the workmanship of construction practitioners and encourage them to "do things right the first time", and also provides high-work motivation by way of rewards granted in terms of tender opportunities and awards (BCA, 2005). With reference to CONQUAS 21, Construction Industry Development Board Malaysia (2006) developed its quality assessment system for building construction work, which is called the Malaysian Construction Industry Standards (CIS 7). Hence, most of the components of quality procedures for building projects tested in this study referred to CONQUAS 21 and CIS 7.

Hong Kong Housing Authority in 2002 issued the PASS manual, which covers measurement and assessment of contractors' work performance. This manual was developed based on CONQUAS, which intends to measure contractors' project output against defined standards as well as to evaluate their performance amongst other similar service providers (Coffey, 2010). From time to time, the PASS manual has been improved and revised in order to provide an enhanced measurement and assessment system relating to management capability and capacity, tendering and contracts matters, contractor responsibilities during maintenance phase, and scoring methodology (Coffey, 2002).

To sum up, the construction performance assessment systems have proved effective in significantly improving the quality of constructed works in the three countries, and in the case of two, their respective construction industries are performing very well in terms of quality as evidenced by the steady improvement of CONQUAS in Singapore (BCA, 2005)

and PASS scores in Hong Kong (Coffey, 2002). This has allowed contractors from all three countries to gain great business competitiveness in the world construction markets. It is therefore obvious that the Indonesian government and its partner's regulations and policies on quality need to be accompanied by an assessment system as a tool to measure and assess the performance of the construction companies in undertaking qualified project works and services at the project task level, company level and their performance among other similar services providers to obtain the level of performance of the Indonesian construction industry.

## 3. Research method

This research study adopted a quantitative method (i.e. questionnaire survey), which aimed to identify the key attributes in undertaking qualified building construction works in the Indonesian construction industry. Considering the information needs, including the type of data required from the designated population and its sample representation for achieving the objectives of the study, according to Sekaran and Bougie (2009, p. 197) "a questionnaire is an efficient data collection mechanism when the researcher knows exactly what is required and how to measure the variables of interest". In addition, a questionnaire survey is suitable when a large amount of data needs to be collected from people in relation to their views and experience relating to a particular phenomenon, and the time available to collect the data is limited (Naoum, 2007; Fink, 2009); these were also the main considerations in this study.

Reviews on the relevant literature and interviews with the officers from the NCSDB and DGCD of the Ministry of Public Works and Housing on the highlighted issues contributed to the development of the questionnaire. The choice of the four experts (two from NCSDB and two from DGCD) was made with regard to their roles as policymakers and in being functional in developing and enhancing the role of the national construction services in becoming qualified and professional organisations capable of undertaking construction projects both nationally and internationally. The informants' consistent inputs on the issues and the research topic have resulted in the development of the chosen attributes, which are considered suitable for the assessment of Indonesian construction project-based performance. Thirty-nine attributes or variables were designed to evaluate the performance of the construction companies during project implementation – 13 variables, in delivering final project results – eight variables, and in implementing quality procedures for building construction works – 18 variables.

Statistical Package for the Social Sciences (SPSS) version 21 was then utilised to analyse the quantitative data. This software helps process, analyse and interpret the data collected, to provide the information needed. Descriptive statistics of mean item score was used for displaying the existing status of the implementation of the attributes of the construction project-based performance, and continued with the analysis of variance (ANOVA) test to determine the difference in the implementation of the attributes across the three contractor qualifications. The results of the data analysis were thereafter used to determine the key attributes, which form the basis of the establishment of the Indonesian quality performance assessment system for building construction work.

A total of 500 sets of questionnaires were distributed to contractors in the five provinces in Indonesia, consisting of North Sumatra (Sumut) and Centre Capital of Jakarta (DKI Jakarta) provinces, which represented the West of the Indonesian region, South Sulawesi (Sulsel) and North Sulawesi (Sulut) provinces which represented the Centre of the Indonesian region, and Papua province which represented the East of the Indonesian region. A total of 216 completed questionnaires were received, consisting of 30 respondents from Sumut, 45 from DKI Jakarta, 42 from Sulsel, 67 from Sulut and 32 from Papua. The selection of these target respondents was based on purposive sampling, which in this study, the targeted respondents representing the three main regions of the Indonesian territory, and were considered appropriate to provide the intended data. Over other sampling methods, the purposive sampling has

advantages in providing research data from the specific types of people who can provide the desired information, or conforming to some criteria set by the researcher (Sekaran and Bougie, 2009). Due to cost, time and operational constraints in collecting research data, the respondents of this study were emphasised on the construction services providers, to provide the initial identification of the construction project-based performance attributes. Therefore, the perceptions of other stakeholders (e.g. project owners and end-user customers) have not yet been accommodated in this study. Table III summarises the background of the respondents based on where they work and what their position categories are.

Table III shows that 121 respondents work at the largest qualification contractors, 33 of them in *B*2 and 88 of them in *B*1, while 95 respondents work at the highest-medium qualification (*M*2) contractors; in these qualifications the implementation of the QMS based on ISO 9001 is required. Indonesian contractors' qualification consists of large qualification (*B*2 and *B*1), medium qualification (*M*2 and *M*1) and small qualification (*K*1, *K*2, *K*3). *B*1 is eligible for project values of up to 19 million USD, while *B*2 is eligible to tender for an unlimited project value. The table also shows that the respondents' positions were making them well qualified to respond to the questionnaires.

The designed questionnaire was on a five-point Likert scale, which depends on the objectives of the data collection. In order to identify the attributes pertaining to the performance of the construction companies during project implementation, the scale ranges from 5 = very often implemented to 1 = having never been implemented; the attributes pertaining to the performance of the construction companies in delivering final project results, the scale ranges from 5 = very often accomplished to 1 = having never been accomplished; and the attributes pertaining to the performance of the construction companies in implementing quality procedures for building construction works, the scale consists of 5 = having the procedures and fully implementing them, 4 = having the procedures but not fully implementing them, 3 = having the procedures but having never implemented, 2 = undertaking the works without the procedures, 1 = having no procedures and having never undertaken the works (< 1.50). Reliability test was conducted on the research instrument using Cronbach's $\alpha$. The $\alpha$-value for the 13 variables is 0.872, 8 variables is 0.912 and 18 variables is 0.966; all were greater than 0.600 signifying that the instrument used for the study is reliable. An $\alpha$ value of more than 0.80 is considered to be good, between 0.70 and 0.80 is acceptable while less than 0.70 is considered poor (Sekaran and Bougie, 2009). Compared to the other type of reliability test (e.g. Cohen's $\kappa$), Cronbach's $\alpha$ is more appropriate to measure the internal consistency of the questionnaire construction (Allen and Bennett, 2010), to which the questionnaire is reliable to measure the respondents' perception on the attributes for evaluating construction project-based performance.

## 4. Results and discussion

The results of the descriptive analysis show that the performance attributes of the construction companies during project implementation are in the level of "very often

**Table III.** Summary of background information of individual respondents

| | Workplaces qualifications | | | | Positions | | |
|---|---|---|---|---|---|---|---|
| Provinces | *B*2 $n = 33$ | *B*1 $n = 88$ | *M*2 $n = 95$ | *N* | Director $n = 91$ | Technic Director $n = 18$ | Project Manager $n = 107$ |
| Sumut | 4 | 9 | 17 | 30 | 13 | 1 | 16 |
| DKI Jakarta | 8 | 5 | 32 | 45 | 20 | 3 | 22 |
| Sulsel | 20 | 17 | 5 | 42 | 1 | 1 | 40 |
| Sulut | 1 | 47 | 19 | 67 | 54 | 4 | 9 |
| Papua | 0 | 10 | 22 | 32 | 3 | 9 | 20 |
| *N* | | 216 | | | | 216 | |

implemented" and "often implemented" (Table IV). These are reflected in the mean scores, which ranged from 3.51 to 5.00. In particular, *B*2-qualification very often implements the attributes of the constructing project according to the specifications in the contract (code 3, mean 4.52), implementing occupational health and safety and environmental procedures (code 10, mean 4.55), and conducting a maintenance to examine how the function of the building after the project is handed over (code 13, mean 4.52). Like *B*2, *M*2-qualification is also indicated as understanding that the project must meet specifications and be maintained during the maintenance period. Meanwhile, besides having two attributes similar to that of *B*2 and *M*2, *B*1-qualification, also very often implements the attributes of constructing sustainable construction projects (code 4, mean 4.53), implementing risk management projects (code 11, mean 4.55), and having a mutually beneficial relationship with suppliers (code 12, mean 4.64). As Table IV indicates, the respondents, in general, understand performing what the construction companies should do during the stage of constructing and controlling project works.

The results regarding the performance attributes of construction products show that the three contractor qualifications accomplished well the attributes. *B*1 contractor is indicated to have very often accomplished most of the attributes, while *B*2 is in the level of often accomplished all the attributes (Table V). As in the attributes of project implementation, on average, the respondents are able to understand the key performance attributes they need to accomplish to meet the satisfaction of project stakeholders.

Table VI shows the results of the descriptive statistics of mean item scores regarding the level of implementation of the standard operating procedures provided in building construction works. It is indicated that all contractors have the quality procedures of QMS (ISO 9001:2015) together with their Occupational Health and Safety Management Systems (OHSAS 18001:2007) and Environmental Management System (ISO 14001:2015) procedures. However, there are several quality procedures that are still improperly implemented, such as the procedure of structural works and the procedure for mechanical and electrical works. It seems that *M*2 contractors do not properly implement most of the building construction work procedures.

Further analysis of ANOVA test was conducted to examine whether the implementation of the attributes (codes 1-39) differ among the three qualifications of respondents.

| Codes | Performance attributes during project implementation | *B*2 Mean | *B*1 Mean | *M*2 Mean |
|---|---|---|---|---|
| 1 | Applying up-to-date and efficient construction methods | 4.18 | 4.25 | 4.17 |
| 2 | Having sufficient professional construction management expertise | 4.24 | 4.39 | 4.40 |
| 3 | Constructing project according to the specifications in the contract | 4.52 | 4.68 | 4.68 |
| 4 | Constructing sustainable construction projects in terms of environmental, social, economic, technical aspects | 4.21 | 4.53 | 4.40 |
| 5 | Constructing innovative construction projects | 3.82 | 4.56 | 4.36 |
| 6 | Improved management capabilities during construction works | 4.21 | 3.98 | 4.45 |
| 7 | Improved internal and external communication during construction works | 4.30 | 4.03 | 4.42 |
| 8 | Customer satisfaction achieved during construction works | 4.33 | 4.45 | 4.45 |
| 9 | Win-win solution basis for project claim | 3.85 | 4.50 | 4.14 |
| 10 | Implementing occupational health and safety and environmental procedures | 4.55 | 4.58 | 4.47 |
| 11 | Implementing risk management projects | 4.42 | 4.55 | 4.32 |
| 12 | Relationship with suppliers based on a mutually beneficial relationship | 4.24 | 4.64 | 4.46 |
| 13 | Conducting a maintenance to examine how the function of the building after the project is handed over | 4.52 | 4.70 | 4.52 |

**Notes:** Level of implementation: 5, very often implemented (mean = 4.51-5.00); 4, often implemented (mean = 3.51-4.50); 3, rarely implemented (2.51-3.50); 2, very rarely implemented (1.51-2.50); 1, having never been implemented (< 1.50)

**Table IV.**
Attributes of project implementation

| Codes | Performance attributes of construction products | *B*2 Mean | *B*1 Mean | *M*2 Mean |
|---|---|---|---|---|
| 14 | The final results of the project (construction products) to meet the target time and costs | 4.18 | 4.67 | 4.53 |
| 15 | Producing quality construction products according to the specifications in the contract | 4.36 | 4.61 | 4.48 |
| 16 | Construction products are free of failure/defective products | 3.91 | 4.44 | 4.36 |
| 17 | Completed construction products in the absence of conflict | 4.24 | 4.55 | 4.45 |
| 18 | Construction products meet social and environmental safety standards | 4.15 | 4.56 | 4.43 |
| 19 | Project implementation teams are satisfied with the end result of the project | 4.24 | 4.64 | 4.55 |
| 20 | Project owners express satisfaction over the project construction products | 4.27 | 4.65 | 4.60 |
| 21 | End users express satisfaction over the project construction products | 4.27 | 4.64 | 4.54 |

**Table V.**
Attributes of construction products

**Notes:** Level of implementation: 5, very often accomplished (mean = 4.51-5.00); 4, often accomplished (mean = 3.51-4.50); 3, rarely accomplished (2.51-3.50); 2, very rarely accomplished (1.51-2.50); 1, having never been accomplished (< 1.50)

| Codes | Component of quality procedures for building work | *B*2 Mean | *B*1 Mean | *M*2 Mean |
|---|---|---|---|---|
| 22 | Procedure for structural work: an examination of scaffolding, reinforcement steel, fabricated structural elements and concreting | 4.88 | 4.62 | 4.51 |
| 23 | laboratory tests of concrete compressive strength | 4.88 | 4.55 | 4.47 |
| 24 | laboratory tests of the tensile strength of steel reinforcement | 4.58 | 4.49 | 4.27 |
| 25 | non-destructive inspection of uniformity and hardness of concrete cover | 4.36 | 4.44 | 4.32 |
| 26 | Procedure for architectural work in designing multi-storey buildings | 4.55 | 4.58 | 4.39 |
| 27 | floor work, inner and outer walls, ceiling, doors and windows, roofs, driveways, patios, and aprons | 4.61 | 4.43 | 4.34 |
| 28 | Procedure for external work, for example: building bridges, drains, footpaths, parking lots, gates and fences, gardens | 4.64 | 4.59 | 4.44 |
| 29 | Procedure for mechanical and electrical work of installation of utility lines | 4.36 | 4.49 | 4.22 |
| 30 | air-conditioning work, mechanical ventilation, fire protection, sanitation and plumbing, elevators, escalators | 3.97 | 4.49 | 4.24 |
| 31 | Procedure for periodic quality checks on temporary projects undertaken | 4.64 | 4.50 | 4.35 |
| 32 | Procedure related to the final outcome of the project: handing over the job | 4.82 | 4.69 | 4.45 |
| 33 | product trials | 4.58 | 4.57 | 4.23 |
| 34 | product quality inspection according to specifications | 4.82 | 4.57 | 4.26 |
| 35 | OHSAS and EMS policy | 4.88 | 4.66 | 4.64 |
| 36 | OHSAS and EMS implementation plan | 4.67 | 4.61 | 4.60 |
| 37 | OHSAS and EMS procedure | 4.67 | 4.59 | 4.58 |
| 38 | OHSAS and EMS monitoring and evaluation | 4.61 | 4.57 | 4.46 |
| 39 | OHSAS and EMS continuous improvement | 4.52 | 4.43 | 4.35 |

**Table VI.**
Building construction procedures

**Notes:** Level of implementation: 5, having the procedures and fully implementing them (mean = 4.51-5.00); 4, having the procedures but not fully implementing them (mean = 3.51-4.50); 3, having the procedures but having never implemented (mean = 2.51-3.50); 2, undertaking the works without the procedures (1.51-2.50); 1, having no procedures and having never undertaken the works (< 1.50)

The results show that there are differences among them relating to several attributes of project implementation, attributes of construction products and most of the components of building construction procedures (see Tables VII, VIII, and IX, respectively).

In regard to the attributes of project implementation, *B*1 contractors are more likely to put an emphasis on undertaking innovative construction projects (code 5, mean 4.56) and building relationship with suppliers based on mutually beneficial relationship (code 12,

| Codes | Attribute/components | Group | Mean | *F* | Significance |
|---|---|---|---|---|---|
| 5 | Innovative projects | *B*2 | 3.82 | 10.22 | 0.000 |
| | | *B*1 | 4.56 | | |
| | | *M*2 | 4.36 | | |
| 6 | Management capabilities | *B*2 | 4.21 | 9.09 | 0.000 |
| | | *B*1 | 3.98 | | |
| | | *M*2 | 4.45 | | |
| 7 | Communication | *B*2 | 4.30 | 5.42 | 0.005 |
| | | *B*1 | 4.03 | | |
| | | *M*2 | 4.42 | | |
| 9 | Win-win solution | *B*2 | 3.85 | 7.47 | 0.001 |
| | | *B*1 | 4.50 | | |
| | | *M*2 | 4.14 | | |
| 12 | Mutually beneficial relationship | *B*2 | 4.24 | 4.90 | 0.008 |
| | | *B*1 | 4.64 | | |
| | | *M*2 | 4.46 | | |

**Note:** Significance $p < 0.05$

**Table VII.** ANOVA results of attributes of project implementation

| Codes | Attribute/components | Group | Mean | *F* | Significance |
|---|---|---|---|---|---|
| 14 | Final project results | *B*2 | 4.18 | 7.83 | 0.001 |
| | | *B*1 | 4.67 | | |
| | | *M*2 | 4.53 | | |
| 16 | Free of failure Products | *B*2 | 3.91 | 6.13 | 0.003 |
| | | *B*1 | 4.44 | | |
| | | *M*2 | 4.36 | | |
| 18 | Social and environmental safety standards | *B*2 | 4.15 | 3.90 | 0.022 |
| | | *B*1 | 4.56 | | |
| | | *M*2 | 4.43 | | |
| 19 | Project team satisfaction | *B*2 | 4.24 | 7.12 | 0.001 |
| | | *B*1 | 4.64 | | |
| | | *M*2 | 4.55 | | |
| 20 | Project owner satisfaction | *B*2 | 4.27 | 5.27 | 0.006 |
| | | *B*1 | 4.65 | | |
| | | *M*2 | 4.60 | | |
| 21 | Project user satisfaction | *B*2 | 4.27 | 5.41 | 0.005 |
| | | *B*1 | 4.64 | | |
| | | *M*2 | 4.54 | | |

**Note:** Significance $p < 0.05$

**Table VIII.** ANOVA results of attributes of construction products

| Codes | Attribute/components | Group | Mean | *F* | Significance |
|---|---|---|---|---|---|
| 34 | Procedure of product inspection | *B*2 | 4.82 | 4.87 | 0.009 |
| | | *B*1 | 4.57 | | |
| | | *M*2 | 4.26 | | |

**Note:** Significance $p < 0.05$

**Table IX.** ANOVA results of building construction procedures

mean 4.64). Meanwhile, *M*2 contractors are more likely to put an emphasis on improving management capabilities (code 6, mean 4.45) and communication (code 7, mean 4.42) during construction works. Regarding the performance of construction products, *B*1 contractors are likely to be trying to deliver products on time and within the budget (code 14, mean 4.67)

and the products are free of failure (code 16, mean 4.44). For them, the success of construction products is in line with the success of the project team (code 19, mean 4.64), the owner (code 20, mean 4.65) and even the end user of the products (code 21, mean 4.64). These large-scale contractors also considered that the issues of social and environmental safety (code 18, mean 4.56) might contribute to the success of construction products. In regard to the conformity of the implementation of quality procedures in building construction project, *B*2 contractors apparently put more emphasis on the products' quality inspection (code 34, mean 4.82) in order to ensure that they meet the specifications.

Implementing QMS ISO 9001 for almost two decades seems to make the largest qualification as the Indonesian construction companies place quality on the first priority. Quality issue in the construction industry has spread among the contractors as evidenced by their substantial efforts to implement the performance attributes and quality components of building construction works. This had confirmed Willar's (2012) and Willar *et al.*'s (2015) studies that the motivations of the contractors in seeking ISO 9001 certification in the first instance were encouraged by positive intentions to successfully operate projects, without substantive time delays and cost overruns. As the previous studies have shown, meeting customer satisfaction through project completion on time and on budget without defect should indicate the successful completion of overall project performance (Zhang and Fan, 2013). The trend to implement quality on construction projects, which Indonesian contractors experience, should be also followed by construction industries in other developing countries.

The results of this study regarding the differences in implementing the project-based performance attributes and components of building construction procedures among the largest qualifications of Indonesian construction companies prove that the highest-medium qualification (*M*2) contractors consider that management capabilities including open communication should advocate the success of their project construction. It can be said that there are several kinds of organisational typologies that are being built within the companies. In Willar *et al.*'s (2016) study, it is found that a strong organisational culture influences successful QMS implementation in Indonesian construction companies. Within the large qualification (*B*1 and *B*2) contractors, customer satisfaction is an absolute target. Yet not negligible, tight business competition among them and with world contractors forces them to be innovative and consistent with the quality of the construction products. This supports the results of the study of Oyewobi *et al.* (2015), who proposed the integrated construction excellence model that can help construction companies to assess themselves, in which client satisfaction was allocated the highest scores. However, although customer focus and other excellent performance indicators are trying to be used within large construction organisations, these parent contractors are still subcontracting medium-qualification contractors that might not possess QMSs to undertake building construction projects.

Although the study is limited to five provinces, focussing on the large construction companies' respondents is strategic as they are the focal points to undertake the quality performance project-based assessment. The present study provides a solution regarding the lack of measurement tools for assessing the largest contractors' performance for services and project results, as well as achievements on the defined KPIs in an Indonesian construction context. Considering that the quality target starts from the largest contractors (2 per cent of the total contractors – *B*1 and *B*2), it is believed that this trend will be widespread in the middle qualification (15 per cent – *M*1 and *M*2) and small construction companies (87 per cent – *K*1, *K*2 and *K*3).

It can also be said that the quality performance of construction products is not only caused by qualified construction processes but is also determined by qualified project planning and control, including the construction management processes. One of the

well-developed tools to cope with the unsuccessful performance of construction product is the application of construction decision-support tools. For example; the application of the dynamic construction visualizer system that enables realistic visualisation of modelled construction operations and the resulting products (Kamat and Martinez, 2002); a data warehouse and a decision support system that can help construction managers view data from various perspectives with significantly reduced query time, thus making decisions more efficient (Chau *et al.*, 2002); 4D Management for Construction Planning and Resource Utilization has been developed by Wang *et al.* (2004), in order to implement the 4D Site Management Model+ for best practice in construction management. These insights can be addressed if future research considers an evaluation of construction project performance concerning the more aspects in construction management processes.

## 5. Conclusion

The aim of the study is to develop attributes for evaluating Indonesian contractors' project-based performances, particularly during project implementation, in delivering project results and in implementing standard operating procedures of building construction projects. Although criteria for successful construction project performance have been discussed in literatures, this paper has established and developed typical Indonesian construction quality performance assessment attributes that are empirically proved. This research study therefore has become a starting point in developing Indonesian own construction quality and performance assessment system.

It is concluded that the awareness of the QMS ISO 9001 possession within the large qualification contractors has leveraged the Indonesian construction companies to promote the quality in undertaking the construction project and delivering the construction product. This is evidenced by the level of implementation of the construction project-based performance attributes including the quality procedures of building construction project within the *B*2, *B*1, *M*2 qualifications contractors. In particular, the *B*1 contractors are identified to have been concerning the importance of meeting qualified construction product for the satisfaction of the project team, project owner and the project end users. From these findings, all the attributes and quality components developed from this study are the substantial indicators for the project-based Indonesian CONQUAS.

The study is limited to the development of attributes of the Indonesian building construction project-based performance assessment system. A follow-up research shall cover the design of the weight of the attributes and assessment components to develop the scoring system, in order to provide a validated comprehensive PASS that could be implemented in the scenario of Indonesian construction industry. In addition, the involvement of various background respondents, such as the project owners and end users, will be further confirmed by the proposed building construction project attributes, even attributes for other types of civil engineering construction projects and construction management processes.



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