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# Preliminary Results of a Questionnaire Survey on the Performance of Digitalized Tools in the Quantity Surveying Practices

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## Abstract

The use of digital technologies in the construction industry is indispensable to construction professionals. Quantity surveyors appear to be threatened at the advancement of digital technology because of a perception that it could take over their professional roles in the industry. They are sometimes the last in the project team to adopt digital technologies such as cost estimating software and building information modelling (BIM). Therefore, there is a need to investigate the performance of projects in which quantity surveyors adopted digital technologies in the delivery of their professional services. A survey of digitalization practices in quantity surveying firms across Pacific Association of Quantity Surveyors (PAQS) countries was conducted to investigate the performance of projects (comprising process performance and final performance) in which digital technologies were adopted. The data received were analysed with mean scores and one-way analysis of variance (ANOVA) tests. The results of the ANOVA tests indicate no significant difference in the performance of digitalized tools across the PAQS country members. It is recommended that quantity surveyors should embrace the use of digital technologies for better performance in the delivery of their professional services on projects. Hence, training in digital technologies relevant to quantity surveying profession is essential.

**Keywords:** construction projects, digitalization, performance, quantity surveyors, software.

## 1 Introduction

Technological advancements cut across all sectors, namely, agriculture, construction, finance, health care, manufacturing, etc. (Mowery et al., 2010). Of the numerous industries, the construction industry is the most backward in the adoption and utilization of technological tools in service delivery to clients (Perera et al., 2020). Surprisingly, quantity surveyors appear to be “laggard” in the use of digital technologies among other construction professionals because of the fear that technology may replace their traditional professional services (Olatunji et al., 2010; Smith, 2004). Meanwhile, the adoption of digital technologies in the quantity surveying profession is able to increase productivity and reduce errors in cost computations on construction projects (Ashworth et al., 2013). The digital technologies in various software such as iTWO Cost X, Buildsoft, BIM, QSPlus and so on recently used by quantity surveyors are in high demand, especially in developed countries (Ekanayake et al., 2022; Smith, 2014), because of their tremendous advantages such as time saving in the preparation of bill of quantities, mistakes minimization, etc. The actual performance of these software in the discharge of professional services of quantity surveyors needs to be examined. Therefore, this study investigated the project performance in which digital technologies were adopted through an online survey of Pacific Association of Quantity Surveyors (PAQS) country members.

## 2 Literature Review

### 2.1 Quantity Surveying and Digitalization

Quantity surveying is a construction profession concerned with achieving financial probity and value-for-money on construction projects throughout a project life (Winch, 2009). The profession is widely known in developed nations such as Australia and the UK (Babatunde et al., 2018), but misinterpreted with land surveying or estate surveying in many developing countries. Quantity surveying professionals are equipped with skills and competencies to compute the cost for actualizing projects, provide cost-related advice to construction stakeholders, namely, clients, contractors, sub-contractors, and so on (Leung et al., 2002). Quantity surveying tasks such as taking-off, cost estimation, etc., are calculated manually, which may contain mistakes or errors that can translate into financial loss or poor decision making. The use of Microsoft excel spreadsheet may reduce errors but can be laborious, and time-consuming for complex projects. In fact, some unforeseen problems on construction projects may not be envisaged without the use of sophisticated digital technologies. Thus, quantity surveying professionals are constantly encouraged to adopt digital technologies, especially building information modelling (BIM) on public sector projects in general and government agencies in particular (Babatunde et al., 2018). A recent interview study of software applications for quantity surveying practices indicated that the digitalization characteristics could be classified into four major dimensions (i.e., work preparation, information updating, information presentation, information exchange) (Leung et al. 2022). Interestingly, the use of digital technologies is gradually gaining attention in quantity surveying across all nations (Edirisinghe and London, 2015), because of its tremendous contributions to construction project performance (Martínez-Caro et al., 2020).

## 2.2 Performance Potential of Digitalization

The execution of construction projects involves multi-disciplinary stakeholders, namely, clients, government, non-government organisations, construction professionals, and so on (Leung and Olomolaiye, 2010). In some situations, most of the stakeholders may not reside in the same state, region, or even country. Through electronic communication platforms such as Zoom, the key stakeholders on construction projects can be engaged early for discussion to commence quickly. Decision-making on construction projects may be effective when the multiple stakeholders are good at the use of information communication technology (ICT). For example, by using cloud storage disks, numerous files may be uploaded and amended in real time by any team members in different locations (Alrukaibani and Chaudhry, 2019). Thus, the decision-making process is simplified, and good progress can be made on the project before the stakeholders physically meet in a face-to-face meeting.

On the other hand, clashes at any stage of construction projects may be identified and detected easily by construction stakeholders when using digital technologies. The early detection of clashes and errors helps to save cost, maintain quality standards, and reduce time overruns on construction projects. In fact, BIM has been an incredible construction digital tool to facilitate timely identification of necessary areas of queries and receiving responses on such queries for construction stakeholders (Ghaffarianhoseini et al., 2017), and the overall presentation and exchange of information on the projects is transparent to all participants (Volk et al., 2014). The productivity of all the construction professionals on projects is enhanced, resulting in constructing many infrastructures of high-quality standards within limited time with the use of digital technologies (Chowdhury et al., 2019). The numerous benefits of using digital technologies on construction projects may also attract clients that desire projects of high quality for execution within a short time (Mohamed and Stewart, 2003).

## 3 Methodology

A large research program relating to an international study of the digitalization practices in quantity surveying firms across was approved by the Pacific Association of Quantity Surveyors (PAQS) in 2021. The first stage involved 48 interviews, and the preliminary results were reported in Leung et al. (2022). The second stage is an online survey relating to types of software used, digitalization characteristics of the software, and performance of projects that adopted digitalization. This current study reports on a part of the results relating to the performance of projects that adopted digitalization. The performance of digitalized tools used in quantity surveying services was investigated using an online survey. The survey instrument comprised three sections: 1) background information, 2) digitalization characteristics, and 3) items of performance of digitalized tools used in quantity surveying practices. This paper focused on the preliminary results from the data of section 3. The questions were asked on a 7-point Likert scale in which 1 stood for strongly disagree to 7 represented strongly agree.

The questionnaire was administered to country member representatives of the PAQS through its secretariat. Of the 15 country members of PAQS, responses were received from nine countries, namely Brunei (4), China (18), Hong Kong (7), Indonesia (6), Japan (1), Malaysia (6), Philippines (5), Singapore (6), and South Africa (6). A total of 59 questionnaires were returned, out of which seven incompletely filled ones were discarded. In addition, one return received from Japan was excluded from the study due to small sample size, resulting in 51 valid responses used for the analysis. The data were analysed using mean scores and one-

way analysis of variance (ANOVA) tests to check the significant differences between the respondents' groups.

## **4 Findings and Discussion**

### **4.1 Background Information of Respondents**

Most of the respondents possessed a bachelor's degree (60.8%), with more than five years working experience in the construction industry (91.2%), and constantly using digitalized tools or software to deliver their professional services. The majority of the respondents were consultants (52.9%), engaged in various sizes of establishment, namely, small-sized firms (39.2%), medium-sized organisations (21.6%), and large-sized establishments (39.2%).

### **4.2 Mean Score and One-Way ANOVA Test**

The mean scores of project performance when digital technology was adopted in different PAQS country members are shown in Table 1. The mean ratings of the process performance ranged from 4.33 to 6.50, which is higher than the mid-point of the chosen Likert scale (i.e., 4.00). This implies that digitalized tools contribute to the process performance of projects in all the participating countries. However, the mean ratings of final performance are in the range from 3.17 to 6.00, representing comparatively weak contribution of digitalized tools on the final performance items. The ANOVA tests reveal that there is no significant difference in any of the performance of digitalized tools across the eight groups. This indicates that all the performance variables for the process and final performance can be discussed together using the overall mean values.

### **4.3 Discussion**

The highest overall mean value (mean = 5.35) among the variables is the ability of digitalized methods to enhance quantity take-off and cost estimation (C2), particularly in Brunei (6.50) and South Africa (6.17). This is consistent with quantity surveyors' measurement tasks (such as cost estimating, tendering, valuing work done, and finalizing accounts) which require taking-off and cost estimating of building or infrastructure elements (Fung et al., 2014; Leung et al., 2002). Therefore, quantity surveyors in PAQS member countries are eager to use digitalized methods for the measurement of construction projects.

The benefit of digitalized methods to facilitate information transfer among project participants (C3) and reduce response time in queries and approval process (C4) are ranked the second, with the same overall mean values of 4.86. Construction projects usually involve various stakeholders, such as clients, architects, engineers, quantity surveyors, building contractors, etc. The effective coordination among these stakeholders is possible when there is information contribution from each member (Sun et al., 2019). Without proper information transfer tools, certain mistakes or difficulties in completing quantity surveying tasks may be encountered, hindering multiple cooperation. Moreover, informational transfer potential (C3) allows sharing of post-reviews after the project, which benefits the further development of both quantity surveyors and organizations (Owusu-Manu et al., 2018). Hence, digitalized tools which ensure speedy information transfer are essential for quantity surveyors, especially in Singapore (mean = 5.67) and Indonesia (mean = 5.33).

Reduced response time in queries and approval process (C4) plays a key role in improving project efficiency, particularly for the quantity surveying practices in Brunei (mean = 5.75) and Hong Kong (mean = 5.71). For instance, clarifications from quantity surveyors on cost-

related issues are often needed, and a quick reply could expedite the payment approval process by architects and clients. When payments are received in a timely manner, contractors and sub-contractors have a good cash flow situation which motivates them to execute construction projects expeditiously. The quality of professional services provided by quantity surveyors can be enhanced if digitalized tools enable them to provide quick responses to queries in a transparent manner (Smith, 2016).

Based on the overall mean value, transparent information transfer process (C6) achieved the fourth highest overall mean score (mean = 4.73), with Brunei (mean = 6.00) and Indonesia (mean = 5.33) at the forefront. In the construction industry, lack of trust has long been an obstacle in terms of cooperation among multiple stakeholders (Lu et al., 2023). Transparent information transfer makes it possible to identify the party that is responsible for the accuracy of information being transferred, and holds parties accountable for the information that they produce and transmit (Zhong et al., 2020). With the use of digitalized methods to transfer information, other stakeholders including quantity surveyors can easily access the information and check the amendment made by others, and thereafter take necessary actions on the project. Thus, the trust level among the stakeholders and quality of projects may be improved via the transparent information transfer process.

Improved productivity on construction tasks (C7) and facilitated early engagement of key stakeholders (C1) share the same overall mean scores, and are jointly ranked fifth (mean = 4.69). With the use of digitalized tools, some degree of automation is possible which improves productivity, thus enabling quantity surveyors to offer services on multiple projects (Wijayakumar and Jayasena, 2013). Construction clients who are willing to pay a premium for using some special digitalized tools may be able to engage competent quantity surveyors for their projects.

Stakeholder engagement is becoming an important factor for building sustainable relationships among the project team members and delivering high-quality outcomes (Yu and Leung, 2018). The results show that the use of digital methods allows early engagement of key stakeholders which may help to reduce potential conflicts and formulate a successful collaboration plan from the very beginning (Bal et al., 2013).

Attracting more sophisticated clients (C8, mean = 4.53) and performing clash detection quickly (C5, mean = 4.33) are ranked the second lowest and lowest among the eight items measured. Generally speaking, quantity surveyors adopt digital tools to improve their work and not to attract clients. However, in Indonesia, attracting more sophisticated clients via quantity surveying firms' use of digital technology appear to be in vogue with its high mean score (5.33). As for clash detection, this is under the purview of designers (architects and engineers) and contractors instead of quantity surveyors, though it is useful to quantity surveying firms in Indonesia.

Table 1. Performance of Digitalized Tools

Items	Overall	Brunei	China	Indonesia	Hong Kong	Malaysia	Philippines	Singapore	South Africa	ANOVA	
	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	F	Sig.
<b>Process Performance</b>											
C1: Facilitated early engagement of key stakeholders.	4.69	4.50	4.45	4.83	4.71	<u>4.33</u>	4.40	<b>5.67</b>	4.67	0.604	0.749
C2: Enhanced quantity take-off and cost estimation.	<b>5.35</b>	<b>6.50</b>	4.91	5.50	5.00	<u>4.67</u>	5.20	5.67	6.17	1.640	0.150
C3: Facilitated information transfer among project participants	4.86	4.50	4.91	5.33	4.57	<u>4.33</u>	4.40	<b>5.67</b>	5.00	0.597	0.755
<b>Final Performance</b>											
C4: Reduced response time in queries and approval processes.	4.86	<b>5.75</b>	4.55	5.00	5.71	<u>4.00</u>	4.20	5.00	5.00	1.171	0.339
C5: Performed clash detection quickly.	4.33	4.75	4.55	<b>5.17</b>	3.86	4.33	4.40	4.50	<u>3.17</u>	0.854	0.550
C6: Enabled a transparent information transfer process.	4.73	<b>6.00</b>	4.55	5.33	<u>4.29</u>	4.50	4.40	4.83	4.50	0.910	0.508
C7: Improved productivity of construction tasks.	4.69	<b>5.75</b>	4.55	5.33	4.57	4.67	4.20	4.83	<u>4.00</u>	0.657	0.707
C8: Attracted more sophisticated clients.	<u>4.53</u>	5.25	4.55	<b>5.33</b>	4.43	4.50	4.40	4.33	<u>3.67</u>	0.652	0.711

Note : Items measured on a 7-point scale where 1= strongly disagree and 7=strongly agree.

Legend : **X** = the highest mean in the overall column in comparing with other items, or the highest mean in the row in comparing with other countries, and  
X = the lowest mean in the overall column in comparing with other items, or the highest mean in the row in comparing with other countries.



## 5 Conclusions

This study investigated how digitalized tools used by quantity surveying firms could improve process performance and final performance of projects among PAQS country members. It was found that the digitalization tools adopted in the provision of quantity surveying services do improve project performance. The most important contributions of digital tools are: efficient quantity take-off and cost estimation; transparent information transfer; and reducing response time. Although there is no significant difference among the eight PAQS countries, respondents from Brunei, Indonesia and Singapore generally rated the performance of digital tools on the high side. It is recommended that quantity surveying firms fully embrace automation of quantity take-off and cost estimation by investing in robust digital tools. It is time to do away with measurement paper and squaring that only quantity surveyors understand what they mean. The second recommendation is to invest in a superior cloud storage platform that enables data storage, sharing and transfer, while maintaining clear digital footprints for accountability. Finally, it is recommended that quantity surveying firms harness digital technology that integrates the different steps in the project life cycle in order to reduce response time in queries and approval processes.

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