Identifying attributes for measuring design professionals’ work quality in project delivery process

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Abstract. Quality has been known as one of the triple constraints in the construction industry. This indicator tends to be used for measuring professionals’ performance in the industry, including design professionals such as architects. Therefore, achieving the highest quality is one of the design professionals’ goals to ensure a successful project. Thus, this study aims to identify attributes that can be used to analyze the extent of design professionals’ work quality in the building project delivery process. This study used a quantitative method by using questionnaire survey for data collection. There were 191 completed questionnaires received from design professionals in Indonesia. Data analysis in this study includes factor analysis, reliability analysis, and descriptive analysis. The results identified that design professionals’ work quality in project delivery process could be measured using two components, namely design quality and quality assurance which previous studies have overlooked. The findings of this study can provide as a literature basis for evaluating design professionals’ work quality in the process of delivering the project which can serve as a valuable feedback for the clients as well as the employers of the consultant firms to identify the extent of their design professionals’ work quality.

1. Introduction
Achieving the highest quality in the construction industry is one of the indicators to ensure a successful project. Therefore, professionals in the industry would try their best to deliver optimum quality to ensure that they can succeed in obtaining another project for the future. This is mainly because clients would prefer to use professionals’ services, which can ensure to give them satisfaction guarantee. In the building project delivery process, clients’ satisfaction can be achieved through the work quality of their people in the project team [1, 2], including architects. As the member in a project team, design professionals such as architects should have appropriate skills to ensure faster project completion and minimize rework [3, 4]. Despite the importance of having good quality in project delivery process, unfortunately, design professionals such as architects have been known to be lacking in understanding the importance of quality management in their work [5] which is resulting in a poor design quality that the architects produced at the design stage as the main reason for under quality projects [6]. However, it is crucial for design professionals to achieve the desired quality in their work to be successful in the industry.

The people factor is very important in the construction project and one that is most challenging to manage. Previous studies have highlighted the importance of achieving the desired quality in the construction projects and how ‘the quality’ indicator plays an important role in assessing the
performance in the construction industry [7, 8, 9]. However, most previous studies tend to assess professionals’ work quality in the construction industry at the final stage or when the project has been completed [10, 11]. On the contrary, assessing design professionals’ work should be conducted during the process of delivering the project instead of at the project completion [12]. Clients and employers in the construction industry can gain benefit from measuring professionals’ work in the process of delivering a project because then they can use the measurement to guide necessary modification to the project and evaluate the design process [13]. Thus, previous studies point to the importance of assessing design professionals’ work quality in the project delivery process. Therefore, the main objective of this study is to identify attributes for assessing design professionals’ work quality in the process of delivering the project and measure the extent of design professionals’ work quality. Practically, the findings can benefit clients, employers of consultant firms, architects, and project team members that seek to improve the quality of their construction projects through their design professionals’ work quality. Thus, quality improvement made in the city’s infrastructure projects shall help to establish a better life quality for the people who live in the city. Theoretically, the identified attributes can provide a literature basis for evaluating design professionals’ work quality for future studies.

2. Design Professionals’ Work Quality
Design professionals’ work quality is highly related to the design that they produced. Every decision made in the design process may influence the construction process, which can be the reason for defects and reworks. Various aspects of performance in the construction project are related to the design quality made by design professionals in the industry, and therefore, it is crucial that a building is properly designed for the community and the people who will occupy the building. Thus, every design decision should be addressed carefully to ensure the best design solutions made to maintain the building quality. Sometimes rework is unavoidable, but design professionals who conduct design process in the best possible way would ensure that defects and rework in the project can be minimized. Maintaining quality in the construction industry has never been an easy task; it requires efforts from people who involve as the project team to work their best to ensure that the project delivery process runs smoothly. People are very important assets for firms in the industry [14]. Therefore, consultant firms who seek to obtain a competitive advantage should manage their quality through their people. One of the important roles for design professionals in project delivery process is to manage quality in their projects. Thus, assessing the extent of design professionals’ work quality is important to identify how well these professionals work in the project delivery process. Several studies have been devoted in measuring how well these professionals’ work quality in the project delivery process. But there has been no certain agreement on how many attributes should be taken as considerations for measuring design professionals’ work quality. The current study proposes seven attributes for measuring design professionals’ work quality in the project delivery process.

2.1. Consistent and high-quality specification
The high-quality specification should be produced during the design project delivery process. The project cost can be reduced, and shorter time of project cycle can be obtained when a thorough and high functional design specification is identified during the early stages of the project [15]. Therefore, in producing a detailed design, architects should ensure that thorough, clear, and consistent specifications with high quality are agreed upon by all professionals involved in the project. The unanimous agreement prevents delays and reworks.

2.2. No rework or deficiency in design
Rework is sometimes unavoidable and may happen because of several changes are made on the site and because of design errors. Accidents mostly can be experienced because of design errors [16]. Therefore, architects should be aware of this problem by giving proper attention to all the
requirements and details in the process of producing design. In doing so, errors could be minimized and eliminated to prevent reworking and deficiencies in the project.

2.3. Aesthetics and quality design
Design quality has been recognized to have a connection with various aspects of performance [17]. Architects’ works are mostly judged by the look of their design [18]. Therefore, architects should maintain the aesthetics and quality of their design because their work is commonly judged by the appearance of the buildings that should be aesthetically pleasing.

2.4. Assistance in producing quality management strategies
All people involved in the project, including the architect, should work together in managing and delivering high quality product to compete in the industry and to satisfy the consumers [19, 20]. Thus, architects should provide assistance in identifying what priorities or strategies should be applied in managing the project quality and bringing satisfaction to the clients and users.

2.5. Assistance in the production of quality manuals.
Quality manuals serve as a document that records the quality practices and policies of firms to increase customer satisfaction [21]. Therefore, to ensure the quality of work, architects should assist in producing quality manuals [22]. In the production of quality manuals, architects should help identify the outputs of each activity in the project, the controls, mechanism, and the flow of activities, among others.

2.6. Design conformance to codes and standard
Standard can be defined as technical specifications, such as dimensional, performance, and safety, among others, which have been approved by recognized standardization bodies, such as ISO, European Standard, and National Standard [19]. Therefore, designs should conform to the codes and standards to provide a guaranteed quality of the final design outcomes for the clients and users.

2.7. Assistance in the production of construction inspection and testing program
The contractor needs to perform several testing procedures and conduct additional tests during construction [23]. Inspecting and testing program are important to be conducted to provide evidence that all components and the construction of the project are carried out accordingly to the contract requirements. Therefore, architects should provide assistance in the production of testing programs and in the inspection of construction processes to maintain the quality of the project, and to ensure tests are conducted for works that require particular tests.

3. Methodology
This study employed a quantitative approach using questionnaire survey to collect data from design professionals or architects who are registered with the Indonesian Institute of Architect (IAI). A total of 300 questionnaires were distributed, 196 were returned but 5 of them were unusable. Therefore, 191 completed questionnaires used for further analysis with the aid of Statistical Package of Social Science (SPSS) software, version 20.0 to meet the study objectives. The study used a self-evaluation method in which the individuals or architects themselves appraise their extent of work quality in the project delivery process. This method has been known in several researches to have a positive impact on the employees’ motivation and increasing accuracy needed by the employers [24, 25, 26]. In this study, frequency and descriptive statistics are used for data analysis and data presentation. The questionnaire is divided into three sections. The first section gathers information on the respondent’s background. The second section consists of seven questions to identify the level of design professionals’ work quality using Likert’s scale in ascending order starting from 1 (very poor) to 5 (excellent). The third section which is the last section solicits respondents’ comments on design professionals’ or architect’s
work quality. Table 1 shows the rating scale used to identify the extent of design professionals’ work quality in project delivery process.

| Work quality              | Mean score |
|---------------------------|------------|
| Very poor work quality    | 1 ≤ x < 1.8|
| Poor work quality         | 1.8 ≤ x < 2.6|
| Satisfactory work quality | 2.6 ≤ x < 3.4|
| Good work quality         | 3.4 ≤ x < 4.2|
| Excellent work quality    | 4.2 ≤ x ≤ 5 |

4. Results and Discussion

There were 191 architects participated in this study. 167 of them were male (87.4%) and 24 of them were female (12.6%). The majority of the respondents (82 respondents) have working experience in the industry for 5-10 years (42.9%), 55 respondents have experience between 11-15 years (28.8%), then 31 of them had 16-20 years of experience (16.2%), 19 of them had experience of less than 5 years (10%), and 4 of the respondents had more than 20 years of experience in the industry (2.1%). Most of the respondents in this study work in private firms (98.9 %) which mostly had been established for more than 10 years (60%).

Validity and reliability test should be carried out for all items in the instrument to achieve the goodness of measures. The validity of the instrument should be established through factor analysis [27] and further, performing factor analysis requires the value of KMO measure of sampling adequacy that should be between 0.5 – 1 so that the variable can be predicted and analyzed [28]. In factor analysis, the Bartlett’s test of sphericity should be significant, where \( p < 0.05 \), to ensure the applicability of the factor analysis to the data [29]. Table 2 presents the results of KMO and Bartlett’s test.

| Attributes                                      | Component 1 | Component 2 | Eigenvalue | Variation (%) |
|------------------------------------------------|-------------|-------------|------------|---------------|
| Design quality                                  | 3.121       |             |            | 44.58         |
| Assistance in producing quality management strategies | .803        |             |            |               |
| Consistent and high quality specification       | .800        |             |            |               |
| Aesthetics and quality design                   | .708        |             |            |               |
| Provide assistance in construction commissioning and testing program | .555        |             |            |               |
Deliver design with no rework & deficiency
Designs are conformed to codes and standards
Assistance in production of quality manuals for construction works
Total Variance Explained (%)
KMO
Bartlett’s Test of Sphericity

The results in Table 3 above suggests that all items in the study have greater loading value than 0.3, which means that all items under design professionals’ work quality in this study can all be retained. The 7 (seven) items used to operationalize design professionals’ work quality were submitted to principal component analysis with varimax rotation. As a result, there were two components with eigenvalues greater than 1 explaining 44.58% and 17.36% of the variance extracted. The scree plot in Figure 1 also suggests retaining two components from factor analysis. Which means, there were two unique dimensions related to design professionals’ work quality derived as a result of factor analysis. The two components were named design quality and quality assurance, the interpretation of the given names for both components was based on the items which load in each component [29].

![Scree Plot](image)

**Figure 1.** The scree plot

Reliability analysis was performed after factor analysis to check the internal consistency of the questionnaire by calculating the Cronbach’s Alpha coefficient. The internal consistency indicates the homogeneity of items that form the construct [27]. Design professionals’ work quality has Cronbach’s Alpha coefficient with a value of 0.787 ($\alpha = 0.787$), which means that all items or questions in this study are good and reliable to measure design professionals’ work quality. The two dimensions derived as a result of factor analysis were also tested, the Cronbach’s Alpha coefficient for the first component (design quality) has a value of 0.737 ($\alpha = 0.737$) and the second component (quality assurance) has a value of 0.721 ($\alpha = 0.721$). The obtained coefficient indicates a good internal consistency [27] and shows an acceptable measure of the questionnaire’s reliability [31].

After ensuring the goodness of measures through validity and reliability test then the descriptive analysis is performed to obtain the objective of the study which is to identify the extent of design professionals’ work quality in project delivery process. Based on the results in Table 4, the results show that among 191 respondents participated in this study, the highest percentage (50.7%) or 97
respondents have good work quality. Then, 85 respondents (44.6%) have excellent work quality and 9 of them (4.7%) have satisfactory work quality.

| Work quality              | Frequency | Percentage (%) | Mean | Median | Mode | SD  |
|---------------------------|-----------|----------------|------|--------|------|-----|
| Very poor work quality    | -         | -              | -    | -      | -    | -   |
| Poor work quality         | -         | -              | -    | -      | -    | -   |
| Satisfactory work quality | 9         | 4.7            | -    | -      | -    | -   |
| Good work quality         | 97        | 50.7           | 4.15 | 4.14   | 4    | 0.44|
| Excellent work quality    | 85        | 44.6           | -    | -      | -    | -   |

The total mean score obtained for overall work quality is 4.15 as shown in Table 4. Based on the rating scale of design professionals’ work quality in Table 1, the mean score which is greater equal to 3.4 and less than 4.2 is considered to have good work quality. Therefore, the result suggests that design professionals or architects in Indonesia have good work quality in project delivery process. The finding in this study implies that mostly design professionals who participate in the study perceive themselves as having good working quality in the project delivery process. The result does not correspond with what previous studies’ findings [32, 33] that design professionals such as architects tend to have underperformance level in terms of their working quality and they tend to produce buildings which have many errors. A plausible explanation would be the differences in the location of this study. The current study was conducted in Indonesia where the majority of the problems that challenge design professionals in Indonesia are more related to environmental problems such as floods and earthquake [34]. Whereas, in Nigeria delays and cost overruns tend to be the major problems in its construction industry [35].

5. Conclusion

In terms of theoretical contribution, the results of the study reveal two components or dimensions for measuring design professionals’ work quality in the project delivery process. The first dimension is the design quality which can be measured using four items, namely assistance in producing quality management strategies, consistent and high-quality specification, aesthetics and quality design, and provide assistance in construction commissioning and testing program. The second dimension is quality assurance which can be measured using three items, namely deliver design with no rework and deficiency, designs are conformed to codes and standards, and assistance in the production of quality manuals for construction works. Both identified dimensions in overall explain 61.94% of the total variance. Therefore, the results can provide as a literature basis for future studies in evaluating design professional’s work quality in project delivery process. In practice, the findings serve as valuable feedback for the clients in the industry as well as for the employers of the consultant firms that generally design professionals in Indonesia have a good working quality in the project delivery process which is shown with the mean score value of 4.15. Evaluating design professionals’ work quality in the project delivery process can also help to improve the infrastructure quality of the city because design professionals or architects themselves can identify how well their work quality in delivering the project and which area that should be improved.

This study has achieved its objectives, however, several limitations exist in this study. This study employs self-evaluation which means to obtain its objective, this study relies on design professionals or architects’ perspectives. Therefore, future studies should include other parties’ perspectives such as clients’ and/or other professionals who work together with design professionals in the process of delivering a project to obtain a more thorough quality assessment. This study has successfully revealed two dimensions which related to design professionals’ work quality in project delivery process that can explain 61.937% of the total variance. Thus, future research should identify other items which
may act as the attributes for measuring design professionals’ work quality in the project delivery process.

References
[1] Azim S, Gale A, Lawlor-Wright T, Kirkham R, Khan A, and Alam M 2010 The importance of soft skills in complex projects Int. J. Managing Projects in Business 5 (1) pp 387-401
[2] Idrus A, Sodangi M and Husin M H 2011 Prioritizing project performance criteria within client perspective J. Applied Sciences, Eng. and Tech. 3(10)
[3] Marisa A 2018 Analysis of architect’s performance indicators in project delivery process, IOP Conf. Series: Earth and Env. Science 126
[4] Yusof N, Ishak S S M and Doheim R 2018 Identifying factors for incorporating spatial data into BIM using the delphi method Cons. Economics and Building 18 (3) pp 1-17
[5] Munting P and Cruywagen H 2008 Quality management in south african architectural practices Building and Environment 43(4) pp 444-452
[6] Nawi M N M, Kamar K A M, Abdullah M R, Haron A T, Lee A and Arif M 2009 Enhancement of constructability concept: an Experience in offsite malaysia construction industry
[7] Aisha A N, Hardjomidjojo P and Yassiери 2013 Effects of working ability, working condition, motivation and incentive on employees multi-dimensional performance Int. J. Innovation, Management and Technology 4 (6) pp 605-609
[8] Manzoni J F 2010 Motivation through incentives: a cross-disciplinary review of the evidence Studies in Managerial and Financial Accounting 20 pp 19-63
[9] Meng X and Gallagher B 2012 The impact of incentive mechanisms on project performance Int. J. of Project Management 30 (3) pp 352-362
[10] Kazaz A, Birgonul M T and Ulubeyli S 2005 Cost-based analysis of quality in developing countries: a case study of building projects Building and Environment 40 pp 1356-1365
[11] Ahsan K and Gunawan I 2010 Analysis of cost and schedule performance of international development projects Int. J. Project Management 28 pp 68–78
[12] Zuo, Q., Leonard, W., & Beach, E.E.M. (2009). Integrating Performance-Based Design In Beginning Interior Design Education: An Interactive Dialog Between The Built Environment And Its Context. Design Studies, 31 (3), p. 268-287
[13] Marisa A and Yusof N 2016 What matters most: performance attribute selection in the design project delivery process Managerial Strategies and Practice in the Asian Business Sector Chapter 12 U Z M Aung and P O de Pablos (USA: IGI Global) pp. 220-237
[14] Yusof N, Abidin N Z and Iranmanesh M 2016 Environmental practices in construction firms Procedia Engineering 145 pp 242-249
[15] Simpson P 2010 Design specification: best practices for team-based design Springer Science Business Media pp 9-13
[16] Love P E D, Lopez R, Edwards D J and Goh Y M 2012 Error begat error: design error analysis and prevention in social infrastructure projects Accident Analysis and Prevention 48 pp 100-110
[17] Cardellino P, Leiringer R and Croome D C 2009 Exploring the role of design quality in the building schools for the future programme. Architectural Engineering and Design Management 5 (4) pp 249-262
[18] Segal P FAIA 2006 Professional Practice, A Guide To Turning Designs Into Buildings (London: W W Norton and Company Ltd)
[19] Manzini R, Regattieri A, Pham H and Ferrari E 2010 Quality management systems and statistical quality control Maintenance for Industrial Systems 17 pp 17-52
[20] Tonchica S 2008 Project strategy management Industrial project management: planning, design, and construction pp 65-75
[21] Lo V H Y, Humphreys P and Sculli D. 2001 The definition method zero applied to ISO 9000 quality manuals The TQM Magazine 13 (2) pp 105-111
[22] Oyedele L O and Tham K W 2005 Examining architects’ performance in nigerian private and public sectors building projects Engineering, Construction and Architectural Management 12 (1) pp 52-69
[23] Jaeger A V and Hok G S 2010 Tests. In: FIDIC-A Guide for Practitioners (Berlin:Springer) pp 283-288
[24] Martin J 2010 Self-concept as persons' understanding and evaluation of their own actions and experiences: looking backward and forward from where we are Advances in Motivation and Achievement 16 pp 167-198
[25] Roch S G, McNall L A and Caputo P M 2011 Self-judgments of accuracy as indicators of performance evaluation quality: should we believe them? Journal of Business and Psychology, 26 (1) pp 41-55
[26] Wibisono D 2011 Manajemen Kinerja Korporasi dan Organisasi: Panduan Penentuan Indikator (Jakarta: Penerbit Erlangga)
[27] Sekaran U 2006 Research Methods for Business: A Skill Building Approach 4th ed (New Delhi, India: John Wiley and Sons, Inc)
[28] Sarwono J 2012 Pendekatan Kuantitatif Menggunakan Prosedur SPSS (Jakarta: Penerbit PT Elex Media Komputindo)
[29] Pallant J 2011 SPSS Survival Manual: A Step by Step Guide to Data Analysis Using SPSS 4th ed (Australia: Allen and Unwin)
[30] Hair J F, Black W C, Babin B J and Anderson R E 2010 Multivariate Data Analysis: A Global Perspective 7th ed (New Jersey: Pearson Education Inc)
[31] Jarkas A M 2013 Primary factors influencing bid mark-up size decisions of general contractors in kuwait J. Financial Management of Property and Construction 18 (1)
[32] Oyedele L O and Tham K W 2007 Clients’ assessment of architects’ performance in building delivery process: evidence from nigeria Building and Environment 42 (5) pp 2090-2099
[33] Katarina W 2013 Peranan Arsitek dalam Proses Perencanaan dan Perancangan Arsitektur. J. Ilmiah Arsitektur UPH 3 (2) pp 153-159
[34] Tanuwidjaja L L G and Leonardo L 2012 Sustainable architectural design in indonesia: responding the current environmental challenges J. Ruas
[35] Aibinu A A and Jagboro G O 2002 The effect of construction delays on project delivery in nigerian construction industry International Journal of Project Management 20 (8) p 593