



Synthesis of Construction Quality Assessment Model in Construction Industry

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Abstract: The achievement of quality is an important component in every handover of a residential project. Good quality plays an important role in creating a good identity for the developer as well as fulfill customer's satisfaction level. Thus, Malaysian developers have started to implement quality assessment in their residential projects. Quality assessment is carried out to evaluate quality of project. However, even though quality assessment is implemented in most of construction projects, it is still a struggle to reach customer's satisfaction level due to the number of defects in their residential properties. Therefore, this research carries the objective of investigate lacking of construction quality assessment and developing a framework on quality assessment to reduce defects in residential projects. This paper review requirements on construction quality assessment models which has been proposed by different researchers. The result of this study used to develop a framework on construction quality assessment to fulfil the important indicators which should be included in a quality assessment. The significance of this study may help contractors to develop projects with less defects and quality residential project.

Keywords: Quality assessment, construction, residential projects, quality, defects

1. Introduction

ISO 9000 series of standards, was introduced on 1987 to improve quality system. This set of standards helps a company to satisfy clients and meet regulatory requirements. These quality standards had a huge impact in Malaysia's construction industry in developing QLASSIC by Malaysia in 2006. QLASSIC was developed based on CONQUAS and used as a guidance during developments. The awareness of quality assessment has increased among developers when clients start to expect projects with zero defects. Objective of construction quality assessment is to evaluate workmanship of workers and produce qualified product based on the relevant standard [34]. However, customers are facing difficulty to reach satisfaction level due to the number of defects in their residential properties. Status of defects in current residential projects are questioning the quality performance level of construction industry [15]. According to the National House Buyer Association of Malaysia, 65 percent of clients are facing defect issue their new units. They received thousands of complaints from house buyers due to the defects. Under the statutory of Sale and Purchase Agreement (SPA), the housing developer has to provide a defect liability period (DLP) to perform rectification work in the case that there are any defects in the new property. With regards to this scenario, the Ministry of Housing and Local Government receiving 5500 – 6000 complaints on defects each year over the last five years [2]. Many of the cases were court appeals for compensation from developers.

Apart from that, the National Housing Tribunal received 6,700 complaints related to defects. According to Minister of Housing and Local Government Datuk Seri Abdul Rahman Dahlan, these cases involved technical claims such as defects in workmanship or non-compliance with the specifications during rectification [11]. This proves that the number of complaints on defects received by developers within the defect liability period could not be controlled for many years

even though quality assessment was implemented in residential projects. According to [1], crack line, fittings corrosion and hollow tiles are common complaints of defects received by developers. [34], mentioned that clients also came across defects such as water ponding, water leaking and improper function of mechanical and electrical items. Those defects may result of improper execution, usage of poor material, lack of supervision, and limited time [48].

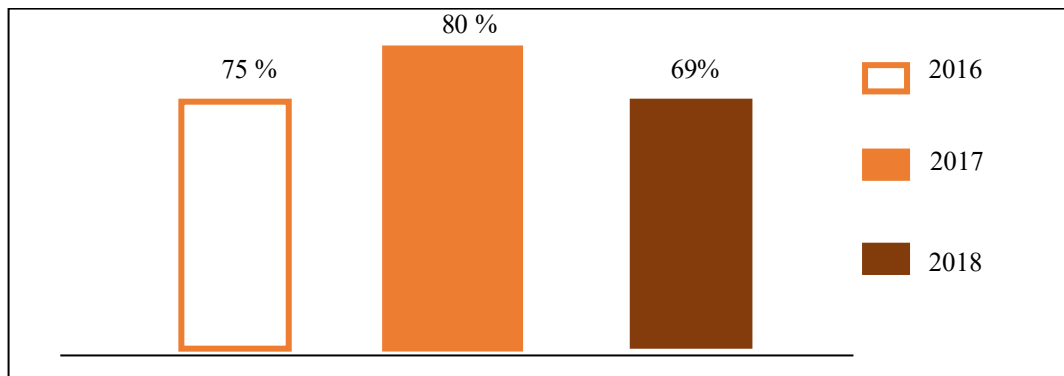


Fig. 1 - User satisfaction level on construction quality assessment from year 2016-2018 [25]

Moreover, user satisfaction level on construction quality assessment reducing by years. Figure 1 illustrates the satisfaction level of users on quality assessment from year 2016 to 2018. This statistic was published by CIDB to represent the performance level of quality assessment in construction projects. From the data in figure 1, user satisfaction level of construction quality assessment was recorded as having an increase from year 2016 to 2017. However, the level dropped in 2018 to 69 percent, which was less than in the year of 2016. The factors that affect the satisfaction level of users are lack of assessor’s expertise and staff assistance [16]. Lack of assessor’s expertise referring to knowledge and skills level in evaluation process. According to Construction Industry Development Board (CIDB) Malaysia’s Deputy Chief Executive, Datuk Elias Ismail, there is still a lack of manpower and staff with a high level of knowledge to carry out inspections. Thus, they are in the midst of recruiting and training more assessors with the hope that in two years they will be able to offer full assessments. According to [36], QLASSIC lacked supervision by assessors on the assessments which appointed CIDB. Assessors are required to attend a course in the early stage of their training period. However, there are no examinations and evaluations on the assessors after the training period. Quality assessors with minimal capabilities and competencies may lead to poor evaluation in construction projects [14].

Moreover, components of quality assessment play a major role in performance level of construction quality assessment. A few hypotheses have been proposed on the lack of performance in construction quality assessment. This proves that Malaysia’s construction quality assessment is lacking which may affect the performance level of quality assessment. According to [9], quality assessment assessors evaluate the basic mechanical and electrical fittings instead of the mechanical and electrical components. Basic fittings refer to the physical appearance of the fittings. However, clients’ reports are higher on functionality of the electrical and mechanical fittings. Moreover, QLASSIC does not carry out evaluation on training and safety management for workers [28]. Training and safety management evaluation are needed to determine the workmanship of workers in construction sites. Apart from that, according to [30], quality assessment does not carry out evaluation on structural and architectural design work. Design defects refer to incorrect or incomplete information and documentation provided by professional designers [10]. Incorrect specifications and uncertain designs always reduce the construction quality. Besides that, quality assessment does not consider and evaluate heavy-duty work. Heavy-duty work refers to earth work which includes soil investigation. Soil settlement work will be carried out by the contractor during pre-construction work. According to [25], 65% of foundation failure cases was occurred due to soil movement. The type and capability of soil must be investigated thoroughly before construction work begins as a precaution against future defects [7]. A lack of quality assessment’s components is a major issue that impacts future defects in a project and also affects the quality of upcoming projects.

1.1 Literature Review

Construction industry plays an important role in countries’ economic growth. In Malaysia, government are kept on research and development to increase more the quality and income from construction industry. New technologies, involvement of professionals and innovate designs and collaboration with other countries are attached to attract local buyers and also to increase investors [15]. In this scenario, quality of a project has to be excellent to reach satisfaction of buyer. The project that has been handover must be quality and safety to be used. However, the previous researches on defect cases and complaints which has been received by local authorizes have indicate that status on number of defects in construction projects are high then expected [4].

1.2 Methodology

A conceptual framework was developed based on preliminary literature review and understanding information gathered by various models and paper by different authors. Construction quality assessment models which involved are from various researches [8], [30], [6] and [12]. Apart from that, various paper's authors are [38], [28], [26], [41], [48], [46].

1.3 Construction Quality Assessment Models from Various Researchers

Quality assessment is built based on each country's construction standards. Each country has their own perception of quality assessment in performing the assessment. In this implementation, researchers have proposed their perception to increase the effectiveness of quality assessment. Thus, different perception from different authors evaluate the important aspects and create a framework on construction quality assessment. Table 1 illustrate previous research on requirements in quality assessment model.

Table 1 - Previous research model on requirements in quality assessment

[8]	[30], [6]	[12]
✓ <u>Corporate quality</u> Top management policy	✓ Stakeholder managerial ✓ Technical ✓ Environmental/material ✓ Culture and politic	✓ Organizational ✓ Technical ✓ Material ✓ Resources
✓ <u>Product quality</u> Schematic design Detailed design Documentation Bidding Construction Output facility Maintenance		
✓ <u>Service quality</u> Gathering information on customers need Formal method Technology Planning tools Quality control system Performance measures		

Requirements in Quality Assessment Model By [8]

A construction project is clarified as teamwork among professionals which consist of different background people working towards developing a project to fulfil customers' requirements. Construction has become a challenging sector worldwide, hence all parties are moving forward to provide good and quality products to their clients. However, developers are still struggling to fulfil customers' needs in terms of quality. Thus, this framework was developed to help build quality projects. This author has proposed a framework which consist of three phases. Corporate quality is referring to managements priority on customers need and safety [7]. Management plays an important role to spread awareness on quality among workers to make sure the product that come to market have be quality and safety to be used by buyer.

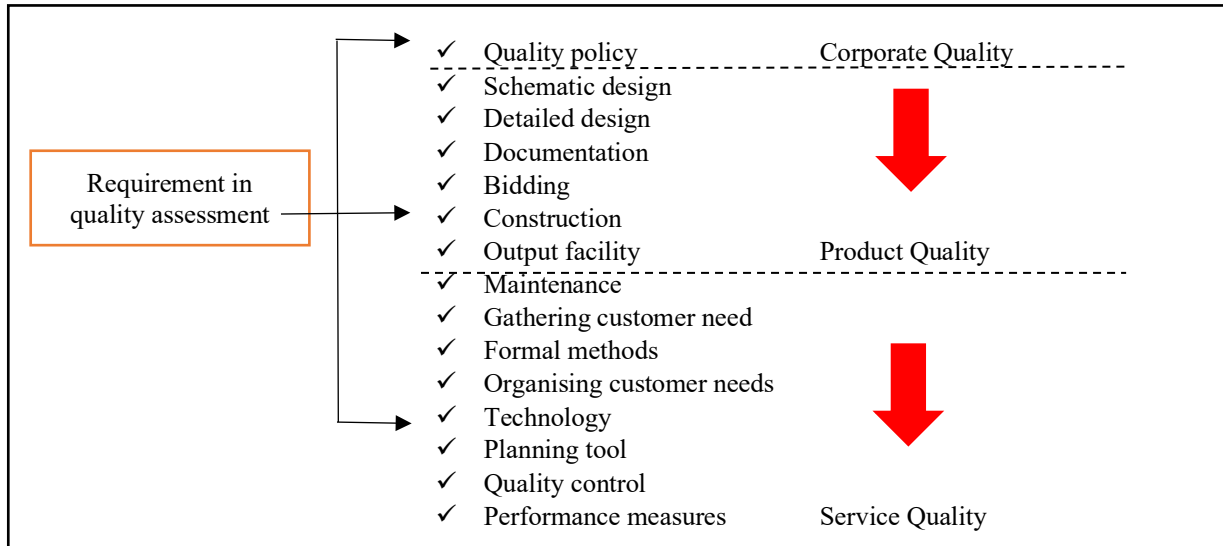


Fig. 2 - Requirements in a quality assessment model [8]

The second stage is product quality. According to [37], eight dimensions have been proposed in the framework for product quality. These are input of customer needs, schematic design, detail on design, documentation, bidding, output of facility, and maintenance. In this phase, the design and build play a major role to developed a quality product. Design a product or project is a foundation for an end product. Thus, evaluation on design have to be done by different qualified professional to avoid any errors in end product [23]. Apart from that, continuous improvement process needed to be conducted to improve the process. Evaluation is an important process which should be conducted in every work [18]. Thus, evaluation has to be done from the beginning until the end of each process to avoid major defect at the end of product. Apart from that, evaluation also has to be done on the tools and technique used by the workers. Technique of a work could be different with each and every worker [5]. However, management have responsibility to standardized the work which applied. It is important to provide a good quality product to users. Moreover, education and training for employees are much needed to provide good and quality service. The management should provide on job training and also keep their workers updated with training. Job-specific skills and specific tools and techniques have to be included in the training.

The third stage is service quality. Service quality is the final stage of a product before it is received by clients. There are seven elements included in the service quality stage which are gathering information on customer’s needs, organizing customers’ needs, formal methods, technology, planning tools, and performance measures. According to [15], inspection is identified as a major activity which is required to evaluate the quality of the project and the tendency of project to fulfil customer satisfaction level. However, inspection has to be done by a third-party professionals). This will help to determine the exact quality and error in projects [29].

Requirements in Quality Assessment Model By [30]

Quality of a project needed to be fulfilled the expectation by contribution in every project. There are many researches has done to found out criteria need to provide good quality product and project. Thus, this framework was developed to propose the requirements on development of quality planning and practices.

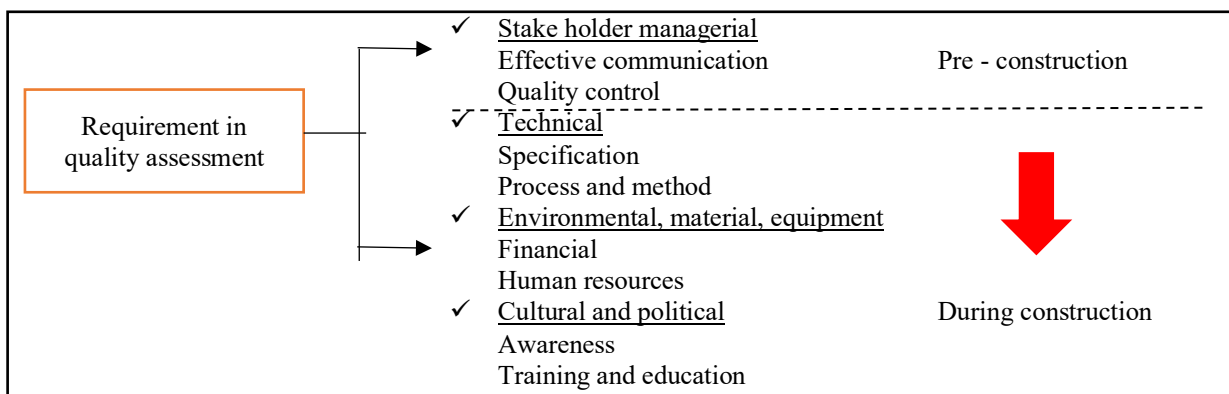


Fig. 3 - Requirements in quality assessment model [30]

Figure 3 illustrate requirements in quality assessment model by [30]. As stated by [45], poor quality performance in construction projects will lead to an increase in cost and time to rework as well as major defects. Moreover, companies have to keep on developing alternative strategies to provide quality products to satisfy customers' needs and safety. However, customers are still facing issue on quality of construction projects. Usage of construction materials which does not meet specified standards will also lead to defects.

According to [47], key stakeholder is responsible for quality problems and defects in construction building projects. According to Amirhossein [6], one of the most important factors which has an important role is effective communication between the parties whom involved in construction projects. To achieve the expected level of project quality, the stakeholder managerial should ensure that all the parties involved in a project receives the same details and information. The framework of requirements in quality assessment includes stakeholder managerial, technical, environment/material, cultural and political [39]. High-quality projects are involving the relationship among the parties involved. Implementation of key project management practices is most substantial issue to achieve desired level of a project. According to [19], most of the quality issue arise due to irresponsibility of management [24]. Miscommunication from management to middle management, workers and co-workers lead to many failure cases. Apart from quality, it also may affect the budget and economy status of a company. Moreover, according to [44], contractors' behavior also being an issue in poor quality project. Mistook in design drawings, careless on handling workers, usage of wrong techniques may lead to not able to provide the end product on site as requested by client and also the specifications.

According to [42], the drawings and specifications for most of the previous cases do not clearly indicate the intentions of clients [20], argue that the design which has developed has to be evaluated by internal and also by third party to make sure the design is developed without any errors and avoid building failure cases. Quality of tools and techniques a have been considering based on type of project and location of project.

Environmental issues and usage of low-quality construction materials have been regarded as a factor which affects the quality of a project. Lacking of attention on important resources such as financial, material, human resource, and technical are also led to projects with poor quality [32]. Thus, materials and techniques which used in construction projects have to be evaluate by the authorized department to ensure the safety and quality of a project [33]. Thus, the involvement of stakeholders and third-party evaluation on technical, environmental, material, and equipment is required to produce a quality end product in construction industry. However, the weakness of this framework is it does not consider evaluation on costs. According to [17], the price of non-conformance averages 30 percent of operating cost and the expenses of poor quality can be avoided by adopting good quality practices. Thus, the cost of a project has to be considered to identify the cost due to re-work and errors in workmanship.

Requirements in Quality Assessment Model By [12]

According to official bulletins (1993-2004), the average distribution of causes of accidents include defects of construction and erection works due to usage of poor quality of materials, external impacts, improper design decision making, and other causes. This shows that, about 60% of accidents was occurred due to usage of poor material and poor workmanship [43]. The reasons of defect origin are error in design, poor quality of materials and products, quality of installation work and operation deficiencies

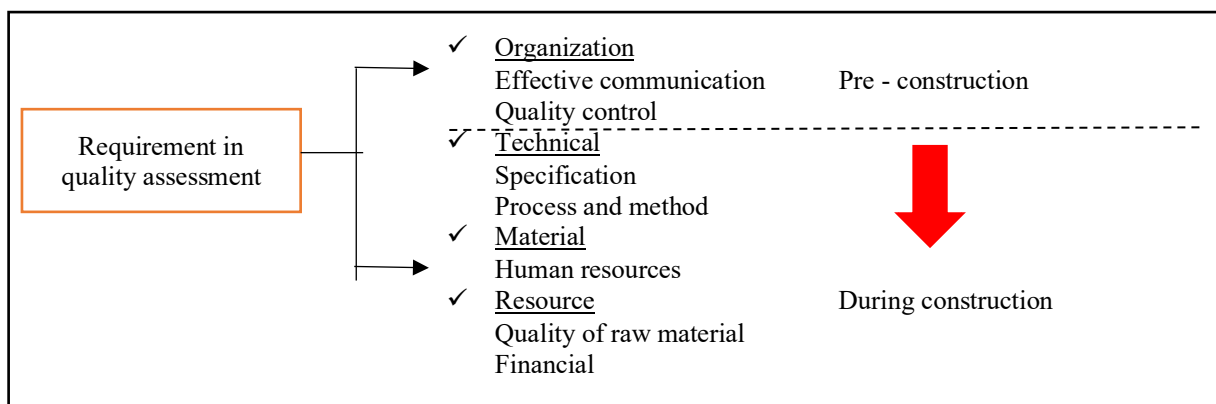


Fig. 4 - Requirements in quality assessment model [12]

According to [12], organization, technical, material and resources have to be considered in quality assessment for an evaluation to be conducted. Organizations have a high responsibility throughout the process starting from planning, execution and completion. Thus, the performance level of an organization has to be evaluated to improve the quality of a project [31]. For example, involvement of technological system which considers objects, tools, performers and processes have to manage by higher management organization. Technical error and performance level of a tool have to evaluate by management professionals to avoid defects in end product [27].

The advantage of this framework is the consideration approach on multi sample for inspections. According to Crosby (1979), inspections is b useful to deliver a project with less project. However, a disadvantage of this framework is the author did not consider the evaluation on run out cost of the project during pre-construction. It is important to identify the run out cost on rectification and errors [49].

1.4 Conceptual Framework on Construction Quality Assessment

In this research, a conceptual framework has developed based on the preliminary literature review and understanding information gathered by various models.

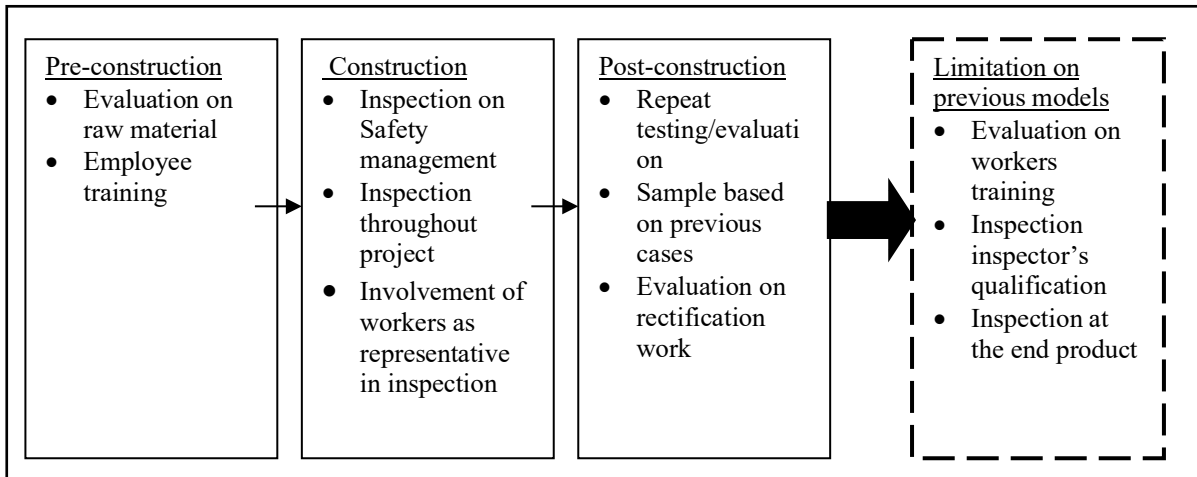


Fig. 5 - Conceptual framework on construction quality assessment

Figure 5 illustrates conceptual framework proposed on construction quality assessment to reduce the number of defects construction projects. This framework has divided into pre-construction, during construction and post construction. In pre-construction process evaluation on raw materials will be held. Inspection on raw material will be carry out and materials which reach the satisfaction level only will be used to manufacturing process. Material efficiency described as the provision of a product and service with less material production [21]. Organization required material with good quality to develop a clear environmental. Standardized methods and techniques needed to be chosen during design stage to improve the material efficiency of a product. Apart from that, inspection on training which provided to workers also carry out to avoid poor workmanship error in production and service.

During production stage, safety management consider as important criteria. In oil and gas industry, safety capability is basically form of enabling capitals. Capability arises through organizational structure such as technology, culture, knowledge management system [40]. Organizational capital stand from processes and routines, HRM systems and information systems. In this capital, evaluation may apply on number of injuries in everyday tasks. Injuries refer to the number of employees those involve in accident during working duration [9]. This is very important to evaluate the high-performance work system among workers. Apart from organization capital, social capital is a part from safety capability. Social capital refers to network of relationship among people in the organization toward safety management [13]. Human capital also one of the important indicators in safety capability. This is referring to knowledge, skills, experience on understanding of safety risks and interpersonal qualities. Thus, evaluation on practice toward safety management is very important to make sure the quality of product in good condition. Apart from that, inspection on product through the manufacturing process is a criterion in quality assessment.

In post-production stage, repeat testing and evaluation carry out on end product to avoid error during inspection. In medical industry evaluation on sampling will be done just for once. But, second time evaluation will be carry out incase occur negative impact on product due to improper transportation, handling and storage during retailing. In case the second sample results the same result, the brand owner shall be advised to given oppotunity to provide samples taken at earlier stage of the supply chain for re-testing [35]. Only samples with similar durability shall be included in sampling and testing to ensure the quality of the product [22]. As a benchmark, the test before/ use-by dates shall be within 20% margin at sampling. Testing shall be carried out within the indicated durability at the same point in time. Apart from that, sampling product also will be choosed based on previous cases. Moreover, evalutaion carried out on rectification work. In manufacturing industry end product will be inspect and incase there was a rectification mean, it will be evaluate again after rectification work [35]. Double evaluation always required to avaid any mislook in end product. Findings from the previous models and authors was evaluated to developed a framework on construction quality assesement.

However, as a summary, limitations from these frameworks have been found out. Limitations are referring to lacking on framework which may affect the effectiveness of quality assessment. Limitations from these frameworks are evaluation on worker's training, inspection inspector's qualification and inspection at end of production. Evaluation on

workers training was being a criterion which used to ignored in certain industry. Workers may stand from production line until top management. Evaluation on each party is must to make sure production and service reach customer satisfaction level. However, evaluations on workers training are not implemented in manufacturing industry. Workers in manufacturing industry are stand from different country [3]. Thus, management should make sure the language and skills which given to workers are fully absorbed by workers. Training and evaluation of all staff is required frequently to make sure the quality of staff in good status Another limitation form industrial quality assessment is inspection inspector's specification. In medical and oil and gas, there is no specifically qualified inspector to carry out inspection on end product. When compare to food industry, they have specific inspector to carry inspection on end product. Qualified inspector has their own capabilities and knowledge on quality of product. Normal workers those involve in production process could not to reach the quality of professional inspector.

Apart from that, inspection on end product is one of the limitations which has found out from different industry quality assessment. According to [17], prevention process should be applying throughout the project to avoid cost run and rectification work after completion of project. Crosby emphasized that quality can be improved when management focuses more on prevention. This needed to be done by attention and awareness on employee, reduction of the cost, and emphasis on controls rather than the inspection efforts. Thus, limitations on quality assessment have to be resolve to improve the quality of end product.

1.5 Conclusion

Quality is an issue which plays an important role in construction. Customers are willing to invest money to receive good quality projects. Quality assessment was developed to ensure that developers provide good quality products to customers. However, the number of defects that arise in construction shows that the mission of quality assessment has not been achieved. The increasing number of defects in construction projects may affect the satisfaction level of customers in Malaysia's construction projects. Thus, this research was carried out to propose a conceptual framework on quality assessment as a resolution for defect issues. This framework may be useful for developers to make sure that good and safe properties are developed. It is important to improve the confident level of local buyers on Malaysia construction product.

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References

- [1] Ahmad, A. O. (2013). Assessing the Implementation of Conquas Standard amongst Contractors towards Improving Quality of Workmanship. *Jurutera*.
- [2] Ahmad, F. (2018). Significant Characteristics of Scheduled and Condition-Based Maintenance in Office Buildings. *J.Perform. Constr. Facil.* 28(2): 257–263.
- [3] Ali, M, C. (2014). Premilinaru findings on potential areas of improvement in QCLASSIC Elixir Project & Quality, 76 (2014) 28341-28349.
- [4] Aliyu, H. A. (2016). Management Problems Associated with Multi-Tenanted High-Rise Commercial Buildings in Kaduan Metropolis, Nigeria. *Civil and Environmental Research*, Vol 8.
- [5] Allotey S.E. (2014). An Evaluation of the Impact of Defects in Public Residential Building in Ghana. *Civil and Environmental Research*, 58-64.
- [6] Amirhossein, (2011). Assessment of requirements for establishment of a framework to enhance implementation of quality practices in building projects. *International Journal of Innovation and Technology Management (ijitm)*, 2(6), pp. 465-470.
- [7] Amith Kan. (2013). A Study of Contribution Factors to Building Failures and Defects in Construction Industry. *Proceeding Engineering*, Vol 20, pp. 249-255
- [8] Aspinwall, E. (2010). A framework for building quality into construction projects. *Total Quality Management*. Vol. 19, No. 10, October 2008, 1013–1028. *Assessment. Bulletin The Ingenieur*, 45(March-May), 51-54.
- [9] Aziz, N. (2015). A Study of Contribution Factors to Building Failures . *The 2nd International Building Control Conference 2011*.
- [10] Argote, L. (2011). Organizational learning: from experience to knowledge. *Organization Science* 22 (5), 1123–1137.
- [11] Baiburin, A. KH. (2017). Ensuring the quality and safety of constructed public buildings: a scientific publication, ABS Publ., Moscow, 2015.
- [12] Barreto, I. (2010). Dynamic capabilities: a review of past research and an agenda for the future. *Journal of Management* 36 (1), 256–280.

- [13] Cama. (2014). Improving Occupant's satisfaction With Effective Maintenance Management of HVAC System In Office Buildings. *Automatic in Construction*. 43: 31-37.
- [14] Chan, A.P.C (2004). Key performance indicators for measuring construction success. *Benchmarking: An International Journal*, 11(2), 203-221.
- [15] CIDB (2018). Impact Study on the Implementation of Quality Assessment System Construction (QLASSIC) for building construction work.
- [16] Crosby, P.B. (1979). *Quality Is Free: The Art of Making Quality Certain*. New York: McGraw-Hill. Dale, B. G.,Wiele, A. V., and Iwaarden, J. V. (2007). *Managing Quality* (5th ed.). Garsington Road, Oxford: Blackwell Publishing Ltd.
- [17] Delgado, D.J., (2005). Improvement tools in the UK construction industry. *Construction Management and Economics*, 23(9), 965–977.
- [18] Deming, W. E. (1986) *Out of the Crisis: Quality, Productivity, and Competitive Position* Cambridge, MA: Cambridge University Press.
- [19] Farooqui, R. U. (2009) "A stepping stone to total quality management for construction companies," presented at the Seventh LACCEI Latin American and Caribbean.
- [20] Friorèse, S. (2012). *Découvrir et comprendre l'Ingénierie Système*. CEPADUES Editions; 2012.
- [21] Gadenne, D. (2009). An investigation of the hard and soft quality management factors of Australian SMEs and their association with from performance. *International Journal of Quality and Reliability Management* 26(9): 865-880
- [22] Golorner, S. G. (2010). *Modern Construction Technologies: monograph*, South Ural State University Publishing Center, Chelyabinsk.
- [23] Hang. (2016). CONQUAS Systems Standard for High Quality Project Management. Vol 1,issue 1,pp 51-87.
- [24] Hassan, P. F. (2011). Tracking Architectural Defects in the Malaysian Hospital Projects. Paper presented at the 2011 IEEE Symposium on Business, Engineering and Industrial Applications (ISBEIA), Langkawi, Malaysia.
- [25] Hong, T. T (2014). Housing satisfaction in medium- and high-cost housing. The case of Great Kuala Lumpur, Malaysia journal homepage: www.elsevier.com/locate/habitatint.
- [26] Isa, H. M. (2017). Tracking Architectural Defects in the Malaysian Hospital Projects. Paper presented at the 2011 IEEE Symposium on Business, Engineering and Industrial Applications (ISBEIA), Langkawi, Malaysia.
- [27] Kam, K, J. (2012). The relationship between motives and benefits on adopting qlassic-cis 7:2006 in Malaysia construction industry. *International Journal for Quality Research*, 6(4).
- [28] Koskela, L. (2003). Is structural change the primary solution to the problems of construction? *Building Research & Information*, 31(2), 85–96.
- [29] Manap, N. (2016) Strength of brick made from dredged sediments *Jurnal Teknologi* 78(3) 87-92.
- [30] Melchakov, A. P. (2014). About urban territories safety, *Bulletin of the South Ural State University, Construction engineering and architecture*. 14(1) (2014) 14–18.
- [31] Mohammed, A. R. (2006). "Quality management system in construction," presented at the ICCL, Johor Bahru Johor, Malaysia, 2006.
- [32] Moody, D. L. (2005). "Theoretical and practical issues in evaluating the quality of conceptual model: current state and future directions," *Data and Knowledge Engineering*. Elsevier, vol. 55, pp. 243-276, 2005
- [33] Mukhtar, C. A (2010). Understanding the Underlying Principles of QLASSIC
- [34] Norizan, H. (2014). Assessing the Implementation of Conquas Standard amongst Contractors towards Improving Quality of Workmanship. *Jurutera*.
- [35] Othman, N. L. (2015). A Case Study on Moisture Problems and Building Defects. *Procedia - Social and Behavioral Sciences* 170 (2015) 27 – 36.
- [36] Preiser, W.F.E. (2005). *Assessing building performance*. Oxford: Elsevier.
- [37] Razak, I. (2016). Different Approaches to Building Management and Maintenance. *Modern Building Materials, Structures and Techniques*, MBMST 2016, 10.
- [38] Saghatforoush, E. (2010)"Effectiveness of constructability concept in the provision of infrastructure assets," presented at the 2011 Conference Queensland University of Technology, Brisbane, Australia, 2010.
- [39] Subramaniam, N., & Omar, R. (2018). Understanding Of Quality Assessment Toward Defect Maintenance In Construction Projects. *Journal for Studies in Management and Planning*, 4, 300-312.
- [40] Subramaniam, N., Omar, R., & Sarpin, N. (2019). Effectiveness of Quality Assessment in Construction Project. *International Journal of Supply Chain Management*, 8, 987-998.
- [41] Tang,W. (2009). "Enhancing total quality management by partnering in construction," *Journal of Professional Issues in Engineering Education and Practice*, ASCE, pp. 129-141, 2009.
- [42] Trivellas, P. (2010). Investigating the impact of service quality and customer satisfaction on customer loyalty in mobile telephony in Greece", *The TQM Journal*,Vol.22No.3,
- [43] Ta, T. L. (2014), *Managing High-Rise Residential Building in Malaysia: Where are we?* Proceedings of the Napree Conference, Inспен, Pp-125.

- [44] Wong, K.Y. (2005). A framework for knowledge management implementation in SMEs. Unpublished PhD Thesis. The University of Birmingham, UK.
- [45] Xiao, F. (2012). Neural Network Based Prediction Method for Preventing Condensation in Chilled Ceiling System. *Energy and Building*, 45(2012), 290-298.
- [46] Ying, Y. S. (2016), Quality management practices and their impact on performance”, *International Journal of Quality & Reliability Management*, Vol. 23, No. 6, pp. 625-646.
- [47] Yung. (2010). "Construction quality in China during transition: A review of literature and empirical examination," *International Journal of Project Management*, vol. 28, pp. 79- 91, 2010.
- [48] Zakaria, N. (2014). Latent defects: Approaches in protecting house buyers rights in Malaysia. Owned by the authors, published by EDP Sciences, 2014.