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INDICATORS FOR MEASURING SATISFACTION TOWARDS DESIGN QUALITY OF BUILDINGS

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ABSTRACT: Design quality is an important component in measuring satisfaction towards total product quality (TPQ) of buildings, the product of construction projects. Design Quality Indicator (DQI), developed by the Construction Industry Council (CIC) in the UK looking at three quality fields, i.e. functionality, build quality, and impact of building in measuring the quality of design embodied in the buildings through feedback and perceptions of all stakeholders involved in the production and use of buildings. Design quality is always a major concern in the Malaysian construction industry. With inspiration from this DQI, this study was carried out to identify indicators for measuring the satisfaction towards design quality of buildings and to evaluate the suitability of the indicators for application in the context of Malaysian construction industry. Through literature survey, 32 indicators of design quality were identified and grouped into the three design quality fields. A questionnaire survey was carried out among Malaysian construction professionals (architects, engineers, quantity surveyors, contractors and developers) to assess the identified design quality indicators in terms of their relevance and significance in the context of construction industry in Malaysia. The survey reveals that access, natural lighting, access and use, structure element, landscape, finishes, location, external environment, urban and social integration and noise are among the design quality indicators that were perceived as the most important to be looked at. In overall, all the indicators are relevant for adoption in the Malaysian construction industry to measure the satisfaction towards design quality of buildings.

Keywords: Design quality indicators, Satisfaction measurement, Stakeholders' perception, Malaysian construction industry,

1. INTRODUCTION

Quality is one of the triple constraints or forces for every construction project besides the other two parameters i.e. time and cost. Adopting the definitions by Webster, Oxford and Cambridge dictionaries, quality can be defined as any character or characteristics that determine whether an object good or bad after measuring the character or characteristics against a standard. The standard refers to specification of the object to be designed [1]. Buildings are design object, the product of the design. Quality of a building is closely related to its architecture to enhance its design quality and satisfy the requirement and expectation of its owner or users [2]. This is in agreement with definition by ISO 9000: design quality is the overall characteristics of an entity (product and service) that satisfies requirement of customers [3].

Satisfaction is a sense of excitement or disappointment after comparing the effects or results received with the expected [4]. Satisfaction is a measure of the difference between actual and expected performance of a product or service to meet the needs and requirements of users and current perspective [5]. The differences can be measured through the satisfaction and comfort of the building users while carrying out their activities that suit the design of the building. Design quality will determine the suitability of buildings and the quality of compliance that shows how the building in accordance with the specifications required by the design [6]. The quality of the design can produce more efficient intermediation services and will improve the work environment for all those who use it [7].

According to Merriam-Webster dictionary, indicator is a sign that shows the condition or existence of something. Design is used as an indicator to measure the quality of performance, conformance and service [8]. Measuring quality of design at different project stages (briefing, design, before occupation and in-use) is useful to set priorities for design, to assess how well the design is meeting the project objectives and to see how the building is performing [9]. The actual result related to the design quality of the building will be only known after several years of building is occupied [10]. During the occupancy stage, measurement and feedback such post-occupancy evaluation (POE) can be carried out to acquire the relevant data to determine the level of design quality in satisfying the needs and requirements of building client/customer/occupants. This approach also can be categorized under satisfaction measurement (SM) which is used to measure the level of project performance [11]. Satisfaction indicators towards design quality can be measured

objectively or subjectively based on experiences and opinion or perspective of publics [12]. At the same time, judgement and perception on design quality of building given by experts who are involve in the production of buildings can be used in providing the basis for measuring design quality [13].

Design quality is always a major concern in the Malaysian construction industry. Construction Industry Development Board (CIDB) Malaysia, a government agency and an important player in Malaysian construction industry emphasizes the issues of quality in Construction Industry Master Plan (CIMP) 2006-2015 under Strategic Thrust 3; strive for the highest standard of quality, occupational safety and health, and environmental practices [14]. Despite this emphasize from the CIDB, the Malaysian construction industry still suffers with many quality-related problems [15], such as quality below expectation [16], low quality finishes on buildings [17], and there is no benchmark to measure the standard of quality of houses constructed by developers [18]. It is indeed a necessity that appropriate mechanism should take place in Malaysian construction industry to resolve quality-related issues especially on design quality.

Design Quality Indicator (DQI), developed by the Construction Industry Council (CIC) in the UK has successfully used in the UK's construction industry since it was launched in 2002. Design quality is a combination of functionality (how useful the facility is in achieving its purpose); impact (how well the facility creates a sense of place); and build quality (performance of the completed facility) [19]. The indicators and evaluation approach can be adopted in Malaysian construction industry with some modification. Therefore, with inspiration from this DQI, the objectives of this study are to identify indicators to measure satisfaction towards design quality of buildings and to assess the suitability of the indicators in the context of the construction industry in Malaysia.

2. INDICATORS RELATED TO DESIGN QUALITY

Over the past decades, measuring and valuing the quality of design draws the attention clients, designers, and other construction practitioners as well as many researchers [20], [21]. There are many indicators were established in order to measure and value the quality of design. This section describes the Design Quality Indicators (DQI) of UK and briefly introduces other indicators that were adopted by other researches.

2.1 Design Quality Indicators (DQI) of UK

The DQI was developed to measure the quality of design embodied in the product, the buildings themselves through feedback and perceptions of individuals who have interest or connection with the product [22]. It is applicable for new or refurbished buildings. It is in the form of a questionnaire which contains a set of statements that collect the views or perceptions of all stakeholders by looking at three quality fields of indicators, i.e. Functionality, build quality, and impact of buildings as illustrated in Fig. 1.

Fig.1 The three quality fields of DQI

Description of each quality field according to [9] is summarised in sub-headings as the following:

2.1.1 Functionality

The functionality of buildings is emphasized on the arrangement, quality and inter-relationship of spaces, and how the building is designed to be useful. It looks into three following aspects:

a. Use - how well the building caters for the functions it may accommodate originally and in the future.
b. Size - the size and interrelationship of the building's, rooms or component spaces.
c. Access - how easy it is for all people to get to, and around the building.

2.1.2 Build quality

The build quality of buildings is evaluated on how well the building is constructed: its structure, fabric, finishes and fittings, its engineering systems, and the coordination of all these and how well they perform. The evaluation is on the following aspects:

a. Performance - the building's mechanical, environmental and safety systems.
b. Engineering - the quality of the building's components.
c. Construction - how well the building is put together.

2.1.3 Impact

The impact of buildings highlights building's ability to delight, to intrigue, to create a sense of place, and uplift the local community and environment, and also the design's contribution to the arts and science of building and architecture. The evaluation includes the following items:

a. Character and innovation - what people think of the overall building?
b. Form and materials - the building's physical composition, scale and configuration within its boundaries.
c. Internal environment - the quality inside the building's envelope.
d. Urban and social integration - the relationship, of the building with its surroundings.

2.2 Indicators of Design Quality from Previous Studies

Thirty-two (32) indicators that were applied for measuring design quality for different types of buildings such as school, residential and hospital as reported in previous studies (from year 1996 to 2014) were identified and tabulated in Table 1.

Table 1 Indicators for measuring design quality of buildings

Indicators / References	[23]	[24]	[22]	[9]	[25]	[12]	[13]	[26]	[27]	[28]	[2]	[29]	[30]	[31]	Frequency
Use			√	√	√		√						√		5
Layout	√	√		√		√									4
Access			√	√	√	√	√		√	√	√		√		9
Space			√	√	√		√		√	√	√		√	√	9
Lighting				√		√		√	√	√	√				6
Open space						√									1
Landscape				√		√		√				√			4
Service						√									1
Natural Lighting				√				√							2
Natural ventilation				√				√							2
Engineering system			√	√	√	√	√						√		6
Security system				√					√		√				3
Energy				√		√									2
Green energy and sustainability				√		√									2
Finishes				√				√	√	√	√			√	6
Structure element		√		√								√			3
Road width												√			1
Building stability		√		√				√							3
Pedestrian walkway				√					√			√			3
Building maintenance	√	√		√						√			√		5
Design	√	√	√	√	√		√	√	√		√	√	√	√	12
Colour				√				√	√	√	√				5
Form and materials	√	√	√	√	√		√	√	√		√	√			10
Comfort				√				√	√	√					4
Internal environment		√	√	√	√		√	√		√					7
External environment				√										√	2
Character and innovation			√	√	√		√								4
Urban and social integration			√	√	√		√								4
Location		√		√		√									3
Visual Effect						√				√					2
Security		√		√				√							3
Noise											√				1

Table 2 Functionality aspect and quality indicators

Indicators	Descriptions
Use	The building easily accommodates the users' needs
Layout	The building layout is easily understood by its users to find their way round the building
Access	The building provides good and safe access for everyone (users and visitors including those with disabilities)
Space	The spaces in building are the right size for their functions
Lighting	The lighting is efficient and allows for different user requirements
Open space	Open spaces around the building appropriately allow sunlight, breeze and space for outdoor activities.
Pedestrian walkway	Building walkway and other walking infrastructure are suitable and pedestrian-friendly.
Service	The building provides essential services to the user
Natural lighting	Position of windows and doors are suitable for natural lighting
Natural ventilation	Position of windows and doors are suitable for natural ventilation

Table 3 Build quality aspect and quality indicators

Indicators	Descriptions
Engineering system	Mechanical and electrical systems in building functioning properly.
Security system	Security system of the building is function properly.
Energy	The building is efficient in its use of energy.
Green energy & sustainability	Building using green energy sources and sustainability system.
Finishes	Building's finishes are suitable and durable.
Structure element	The building's structure is efficient.
Road width	The road width of the building is suitable.
Building stability	Building is stable from natural elements (e.g. wind and rain) and natural disaster like floods and earthquake.
Landscape	Landscape around the building provides pleasant view and atmosphere
Building maintenance	Building is maintained properly.

Table 4 Impact aspect and quality indicators

Indicators	Descriptions
Design	The design of building gives the building a distinctive character.
Colour	Building colour is suitable for the building.
Form & Material	The building has the shape and materials in accordance with the functions.
Comfort	Buildings provide comfort to the user.
Internal environment	Atmosphere in building, relation between light and space and working climate at workplaces provide comfort.
External environment	External environment is conducive for mobility and outdoor activities.
Character & innovation	The impact of buildings on the character, thinking and human appearance.
Urban & social integration	Interaction with private and public areas and the impact of buildings on the area and community.
Location	The building is well located in the neighbourhood.
Visual effect	The scene of the building is attractive.
Security	The building provides a sense of security.
Noise	Surrounding noise of the building is not intrusive and affects human health.

Design, forms and materials, access and space are the four indicators being most frequently used and highlighted by many researches across the timeline. There are some indicators such as open space, service, road width, and noise although with frequency 1, are considered in this study as the low frequency does not necessarily means irrelevant or insignificant.

Based on the DQI construct, the thirty-two (32) indicators were then grouped into the three quality fields as listed and described in Table 2, Table 3 and Table 4.

3. METHODOLOGY

3.1 Questionnaire Development and Sampling Frame

Quantitative approach using questionnaire surveys has been used to collect data. The questionnaire survey was intended for eliciting feedback on the suitability or significance of the design quality indicators which are grouped under three categories i.e. functionality, build quality and impact in the context of Malaysian construction

industry. A pilot test was conducted before distributing the questionnaire to respondents for actual survey.

The targeted respondents for this study were key construction players such as architects, engineers, quantity surveyors and developers. Questionnaires were distributed to 70 established construction companies representing the key construction players in Malaysia to elicit feedback from 300 respondents. This phase involves postal surveys via ordinary mail.

3.2 Data Analysis

A five-point Likert-scale with options ranging from "1 = Not Significant" to "5 = Very Significant" has been adopted to elicit feedback on the indicators. In order to determine the level of significance of the indicators, average index (AI) analysis was carried out. The interpretation of the AI value (adopted and modified based on [32]) is shown in Table 5.

Table 5 Average index (AI) range value and interpretation

AI range value	Interpretation
$4.50 \leq$ AI < 5.00	Very Significant
$3.50 \leq$ AI < 4.50	Significant
$2.50 \leq$ AI < 3.50	Moderately Significant
$1.50 \leq$ AI < 2.50	Less Significant
$1.00 \leq$ AI < 1.50	Not Significant

4. RESULT AND DISCUSSION

4.1 Background of Respondents

Eighty-eight (88) respondents completed and returned the questionnaires; make up the valid response rate at 29%. This is close to the 25-30% normal response rate for construction research that was suggested by [33]. Most of the respondents are engineers (33%), contractors (23%) and developer (17%). The remaining respondents are quantity surveyors (11%), architect (3%) and other construction project personnel such as project manager and landscape architect (13%). The majority (64%) of the respondents have bachelor degree. 23% of respondents have diploma degree. Respondents with higher degree level (master and PhD) accounted for 11%, and the remaining 2 % have qualification below diploma level.

For their working experience, most of the respondents (52%) have worked in the construction industry less than 6 years. The involvements of these respondents were reasonably balanced by those who have worked for more than 6 years up to 20 years or more (48%). This provides a substantially reliable data for this study as their feedbacks represent the perspective of the key construction players in Malaysian construction industry.

4.2 Perception on Indicators of Design Quality

As shown in Fig. 2, 3 and 4, the AI value of all the indicators under functionality, build quality and impact aspects are within the range of 3.50 < AI < 4.50, suggesting that all the indicators are significant to be considered in measuring satisfaction towards design quality of buildings in Malaysia.

4.2.1 Perception on functionality

Under functionality aspect, natural lighting, access and use scored the highest AI values (Fig. 2). Buildings in Malaysia are expected to be designed to efficiently utilise the natural lighting to light up the indoor considering Malaysia is a tropical country with abundance of natural-light. The importance of this indicator is in agreement with Uniform Building by Laws (UBBL) of Malaysia which specifies certain daylight factor to ensure building occupants are provided with good levels of daylighting.

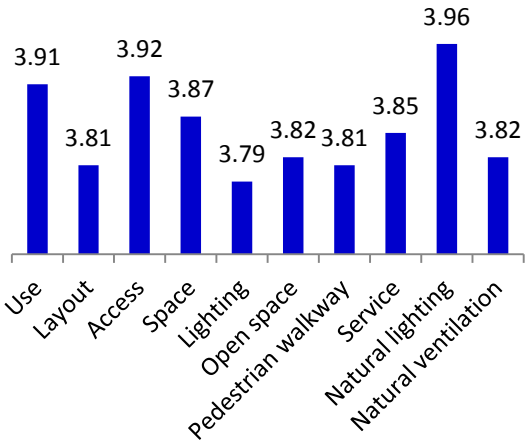

Fig.2 AI value of indicators - functionality

A building with good access to its users especially users with disabilities is perceived as a significant indicator to measure design quality. In Malaysia, there is a growing awareness, efforts and commitment of key building stakeholders to improve the accessibility of buildings especially for users with disabilities [34].

In terms of use, it is important for a building to be able accommodating users' needs. Users need may change over its lifetime. Therefore, a building should be adaptable to respond effectively to these

needs. From this survey, it is obvious that in Malaysia, the ability of building to easily accommodate users' need can be used as an indicator of good quality of design.

4.2.2 Perception on build quality

In the context of build quality (Fig. 3), structure element of buildings such as beams, columns and floors which are efficient is considered as significant build quality indicators with the highest AI value (4.01). This preference indicates that most of the respondents especially engineers hold principle that the efficiency of the structure elements is very critical to satisfy challenging and creative architectural designs, and will lead to buildings that are of high build quality.

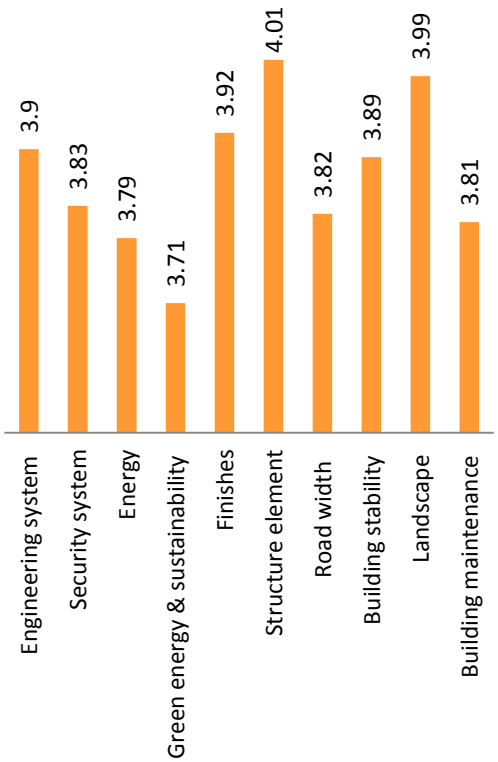

Fig.3 AI value of indicators - build quality

Landscape scored the second highest AI value. In Malaysia, landscape around the building is not only to be attractive, but at the same time, it should be designed to reduce heat island effect. Landscaping in forms of greenscape, hardscape and water bodies is emphasized as one of effective measures to reduce urban heat island in the Green Building Index (GBI), the first green building rating tools in Malaysia. Pleasant view and atmosphere as a result of the landscaping will also strengthen the identity and character of the building. Whether or not landscaping around building successful to provide pleasant view and atmosphere can be used as an indicator for build quality of a building in Malaysia.

Finishes that are suitable and durable are perceived by the respondents as significant (third highest AI value) in measuring build quality of a building. Generally building finishes can be divided into exterior and internal and they provide aesthetics and visual finish to the building. Among the basic durability characteristics of the finishes are withstand thermal and moisture movement and strongly bonded to structural substrate [35].

4.2.3 Perception on impact

Among the indicators under impact, location scored the highest AI value. External environment, urban and social integration and noise were perceived by most of the respondents as significant indicators for measuring impact quality of a building with same AI value (Fig. 4).

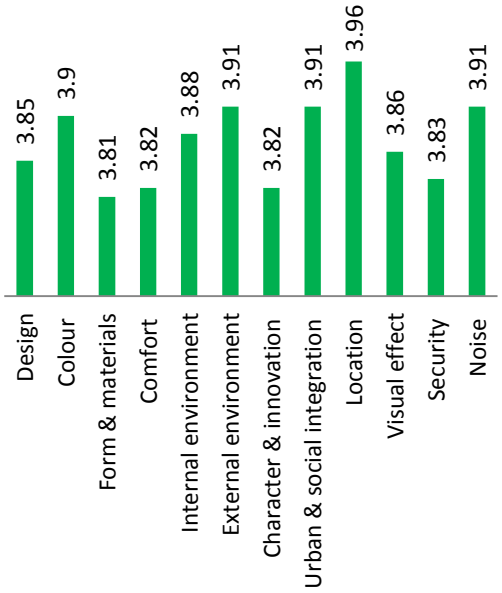

Fig.4 AI value of indicators - impact

Positioning of building in appropriate location or local environment will help the building to create a sense of place. Being well located in the neighbourhood, a building also may enrich the provision of local amenities. External environment that is conducive for mobility and outdoor activities is one of the desired good impacts that a building is expected to contribute to its users, and surrounding community. Surrounding noise of the building may pose challenges to building design. The surrounding noise should be properly catered in the building design to ensure it is not intrusive and affects human health.

Urban and social integration is about interaction with private and public areas and the impact of buildings on the area and community. The social needs of the building neighbours should

be considered. How the building existence can provide opportunity to offer amenities and facilities, transportation links, job opportunities and economics for the surrounding community are among other things that should be on agenda [36].

5. CONCLUSION

Indicators to measure design quality that has been adopted in the DQI of the UK and other previous studies can be adopted in Malaysian construction industry with some modification. The survey conducted to assess the suitability of the indicators, revealed that all the indicators are significant in measuring the design quality of buildings in the context of construction industry in Malaysia. Natural lighting, access and use, structure element, landscape, finishes, location, external environment, urban and social integration and noise are among the indicators perceived as relevant and significant in measuring design quality of building under the foregoing three quality fields.

This research has collected perception from key construction players. Further survey to elicit perception from buildings' owners and users would be useful in ensuring the indicators to measure design quality of buildings represent the whole spectrum of building stakeholders. The ascertained design quality indicators are then likely to be useful to all building stakeholders especially owner, user, contractor and designer who have direct participation in producing or utilising the building. The work is also expected to support the existing green building assessment system and any sustainability initiatives in the country particularly on eliciting stakeholders' perception on the actual design quality of buildings.

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7. REFERENCES

[1] Aas, EJ., "Design quality and design efficiency: definitions, metrics and relevant design experiences", in 1st International Symposium on Quality of Electronic Design (ISQED), 2000, pp. 389-394.

[2] Abu Samah, Z, Ibrahim, N, & Amir, JS, "Translating quality care factors to quality space: design criteria for outpatient facility", Procedia - Social and Behavioral Sciences, Vol. 105, 2013, pp. 265–272.

[3] David, H, "ISO 9000 Quality Systems Handbook", 4th ed. Butterworth-Heinemann: Oxford, 2001.

[4] Xiaozhong, Y and Haishuang, L,"The fuzzy comprehensive evaluation of stakeholder's satisfaction in construction project", in Proc. Int. Conf. on Computers and Industrial Eng., Jul. 2009, pp. 1137–1142.

[5] Ibem, EO, Opoko, AP, Adeboye, AB, & Amole, D, "Performance evaluation of residential buildings in public housing estates in Ogun State, Nigeria: Users' satisfaction perspective", Frontiers of Architectural Research, 2013, 2(2), pp. 178–190.

[6] Wu, L, "Managing design quality and conformance quality: models and insights", Total Quality Management, 2010, Vol. 21:4, pp. 383–389.

[7] Farooqui, RU, & Ahmed, SM, "Designing for quality : an empirical study of design quality indicator (DQI) tool", Building Research & Information, 2009, pp. 1–7.

[8] Murthy, D. N. P., & Ravi Kumar, K. (2000). Total product quality. International Journal of Production Economics, 67(3), 253–267.

[9] Construction Industry Council (CIC), Design Quality Indicator Online, www.dqi.org.uk, accessed on 6th December 2010.

[10] Giddings, B, Sharma, M, Jones, P and Jensen, P, "An evaluation tool for design quality: PFI sheltered housing", Building Research & Information, 2013, Vol. 41: 6, pp. 690–705.

[11] Masrom, MA, Skitmore, M and Bridge, A, "The identification of Malaysian contractor satisfaction dimensions: a strategy for continuous improvement", in Proc. 4th Int. Conf. on Construction Eng. and Proj. Mgmt., 2011, accessed through http://eprints.quit.edu.au/.

[12] Eley, J, "Design quality in buildings", Building Research & Information, Vol. 32:3, 2004, pp. 255–260.

[13] Volker, L, Lauche, K, Heintz, JL, & De Jonge, H, "Deciding about design quality: design perception during a European tendering procedure", Design Studies, Vol. 29, 2008, pp. 387-409.

[14] CIDB, "Malaysian Construction Industry Master Plan 2006 – 2015". Kuala Lumpur, CIDB.

[15] Kamal, EM, Haron, SH, Md Ulang, N and Baharum, F, "The Critical Review on the Malaysian Construction Industry", Journal of Economics and Sustainable Development, Vol.3:13, 2012, pp. 81-87.

[16] Ibrahim, AR, Roy, MH, Ahmed, Z and Imtiaz, G, "An Investigation of the Status of the Malaysian Construction Industry", Benchmarking: An International Journal, Vol. 17:2, 2010, pp. 294-308.

[17] Hamid, ZA and Kamar, KAM, "Modernising the Malaysian Construction Industry", W089-Special Track 18th CIB World Building Congress. pp.267-280.

[18] Sufian, A & Rahman, RA, "Quality housing: Regulatory and administrative framework in Malaysia", International Journal of Economic and Management. Vol. 2:1, 2008, pp. 141-156.

[19] Office of Government Commerce (OGC), "Design quality: Achieving excellence in construction procurement guide", 2007, UK.Commerce

[20] Gann, D and Whyte, J, "Design quality, its measurement and management in the built environment", Building Research & Information, 2003, pp. 314-317.

[21] Deewuf, G, and Van Meel, J, "Sense and nonsense of measuring design quality", Building Research & Information, 2004, pp. 247–250.

[22] Gann, DM, Salter, AJ & Whyte, JK, "Design Quality Indicator as a tool for thinking. Building Research & Information, Vol. 31:5, 2003, pp. 318–333.

[23] Low, SP & Willie, CKT, "The influence of workload instability on quality in the construction industry", International Journal of Quality & Reliability Management, Vol. 13:3, 1996, pp.42 – 56.

[24] Abdul-Rahman, H, Kwan, CL & Woods, PC, "Quality function deployment in construction design: application in low-cost housing design", International Journal of Quality & Reliability Management, 1999, pp. 591-605.

[25] Thomson, DS, Austin, SA, Devine-Wright, H, & Mills, GR, "Managing value and quality in design. Building Research & Information", Vol. 31: 5, 2003, pp.334–345.

[26] Yongqiang, S, & Qiangli, L, "Evaluation method of building engineering design quality", 2nd IEEE Int. Conf. on Information Management and Engineering, 2010, pp. 634–637.

[27] Abu Samah, Z, Ibrahim, N, Othman, S & Abd Wahab, MH, "Assessing quality design of interiors: a case study of a hospital outpatient unit in Malaysia", Procedia - Social and Behavioral Sciences, Vol. 35, 2012, pp. 245–252.

[28] Stringer, A, Dunne, J, & Boussabaine, H, "Schools design quality : a user perspective", Architectural Engineering and Design Management, Vol. 8:4, 2012, pp. 257–272.

[29] Cook, JA, Bose, M, Marshall, WE, & Main, DS (2009). How Does Design Quality Add to our Understanding of Walkable Communities ?", Landscape Journal, Vol. 32:2, 2013, pp. 151-162.

[30] Amer Hatem, W, "Comparing Design Quality for School Buildings in Iraq (Directorate General of Education in Diyala Case Study)", http://fte.edu.iq /upload/upfile/ar/12165.pdf., accessed on Jan. 2014.

[31] John, R, Smith, A, Chotipanich, S and Pitt, M, "Awareness and effectiveness of quality function deployment (QFD) in design and build projects in Nigeria", Journal of Facilities Management, Vol. 12:1, Jan. 2014, pp.72 – 88.

[32] Abd Majid, MZ & McCaffer, R, "Assessment of work performance of maintenance contractors in Saudi Arabia", Journal of Management in Engineering, 1997, pp. 91-91.

[33] Fellows, R and Liu, A, "Research methods for construction", Blackwell Science, 1997.

[34] Hussein, H and Mohd Yaacob, N, "Malaysian Perspective on the Development of Accessible Design", Asian Journal of Environment-Behaviour Studies, Vol. 3:8, April 2012, pp. 101-116.

[35] Stephen, E, and Christopher, AG, "Barry's Introduction to Construction of Buildings**",** John Wiley & Sons, 2013.

[36] Ali, M, and Aksamija, A, "Towards a better urban life: integration of cities and tall buildings", in Proc. 4th Architectural Conference on High Rise Buildings, June 2008, Council on Tall Buildings and Urban Habitat.

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