ENHANCING COMPETENCIES OF QUANTITY SURVEYORS IN COST MANAGEMENT OF MECHANICAL AND ELECTRICAL SERVICES

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ABSTRACT

Quantity surveyors (QS) play an important role in any construction projects such as mechanical and electrical (M&E) projects but there has been less participation of the profession. The study is aimed at improving QS competencies to provide better cost management for M&E services. A mixed methodology was used for this study, the questionnaire was structured on a five-point Likert scale to elicit the opinion of respondents. Semi-structured interviews were also conducted with some experts in M&E services who have met some criteria for selection. Descriptive and Inferential statistical method was used in the analysis of data collected. The most important strategies for the cost management of M&E projects were site exposure of QS to M&E works, advanced educational training of M&E services, as well as improvement of QS curriculum to multidimensional needs and expected standard for M&E, works. Kruskal Wallis was adopted to examine the difference in the opinions of professionals. The results showed that all the professionals have different opinions for all the variables except for the QS curriculum should be updated to multidimensional needs and expected standard M&E works. The study concluded that for the competencies of quantity surveyors to be enhanced, there is a need for exposure to M&E works and training should meet up to the expected standard of client needs. The study recommends that academic institutions and professional bodies should update the curriculum to the multi-dimensional needs of clients so that graduate QSs will be able to face the challenges and threats in the industry

Keywords: Building Service, Competencies, M&E Services, Professional Service, Quantity Surveyor, Strategies

1. INTRODUCTION

Mechanical and Electrical (M&E) services are complex element of building and their values constitute a significant component of construction costs (Yusuf and Mohammed, 2015). M&E services can account for up to 10 to 70% of the construction cost which must be properly monitored so that total construction cost will not escalate more than the initial budget or sum (McCaffrey, 2011). The quality and improvement in the standard of living of people have affected how the building is designed and constructed. Consequently, the design of M&E services in building projects is becoming more complex thereby creating an enormous cost management gap in pricing and rework (Babalola and Adesanya, 2007; Qinjun et. al., 2018). It was noted that some Quantity surveyors are not competent enough to price and manage the cost of M&E services (Babalola 2012; Olarenwaju and Anhave, 2015)

Competence can be described as an action, behavior, or outcome that a person should be able to demonstrate or the ability to transfer skills and knowledge to new situations within a given occupational area (Dada and Jagboro, 2012). It can also be defined as a set of skills that an individual has to possess to satisfactorily perform a specified job (Shafiei and Said, 2008). The Royal Institution of Chartered Surveyors (RICS), Pacific Association of Quantity Surveyors (PAQS), and Australian Institute of Quantity Surveyors (AIQS) have presented at one time or the other competence standards for quantity surveyors (AIQS 2012; RICS 2014). These standards set out the requirements for the assessment of quantity surveyors' competence by listing the type and competence areas. However, the general literature on quantity surveying skills and competence illustrates a multiplicity of perspectives (Nkado and Meyer, 2001; Babalola, 2009). A detailed review of various classifications and definitions of skill and competence reveals that they are very much at variance.

Quantity surveying practitioners have to constantly face challenges and new opportunities and are therefore

required to have distinct competencies to excel in their field. However, the industry is also concerned about the mismatch that exists between QS attributes and industry requirements in areas of competencies (Egulu, 2004; United Nations, 2005). Industry views QS as lacking in knowledge in construction technology and in the understanding of on-site conditions that express their discontentment with the competencies of practicing QS (Perera et al., 2010).

According to Crafford and Smallwood (2007) who studied quantity surveyors' competencies from the client perception was not holistic in view because it examines the work from client perception only which is not best in judging competencies. There are differences between self-perception and the way other professionals in the construction industry view quantity surveyors' competencies are set to be abridged. Also, Babalola (2009) assessed the core competencies of quantity surveyors in electrical works. However, most of the recent literature reviewed competencies from the perspective of value management, Construction industry (Mohd Shafiei and Said 2008; Oke and Ogunsemi, 2009; Oke and Ogunsemi, 2013; Yogeshwaran, Perera, and Ariyachandra 2018). Oke, Ogunsemi, and Adeyelu (2017) explored the skills and competencies of Quantity surveyors in procurement management in Lagos state. Based on the review of recent literature it shows that there exists little or no current research on competencies of quantity surveyors on mechanical and electrical services.

This study will help professionals who are involved in mechanical and electrical works to know ways to enhance competencies. This will enhance competency-level benchmarking which in turn bridges the expectations of the construction industry and actual competencies acquired by the quantity surveying graduates. This research has significance in terms of its theoretical and practical contributions to the existing body of research knowledge. The theoretical contribution gave a high level of knowledge in the strategic management of M&E services. This knowledge is valuable for academic institutions that offer quantity surveying programs, practicing quantity surveyors, mechanical and electrical firms, and other players in the construction industry. It is therefore pertinent to inquire into various strategies to enhance competencies so that there can be a high performance of experts engaged in M&E services

2. LITERATURE REVIEW

2.1   Strategies to enhance quantity surveyors' competencies in cost management of M&E services

Shittu and Izam (2011) noted that costs related to mechanical and electrical services may represent 10-15% of the initial capital cost and a substantial amount of cost-in-use and in some buildings such as laboratories, the services constitute above 50% of the initial cost. Quantity surveyors need to be competent in costing and managing M&E services, the use of bills of quantities for building services work enhances effective cost management (Ebekozien, 2014). Detailed bill of Quantity of M&E services which include materials, labor, and workmanship and quantity enhances effective cost control and management. According to Opawole and Alao (2015), there would be better cost performance of estimates when engineering services were included as measured quantities as against the use of PC sum that is why training is inevitable.

Training has been identified as the fundamental approach that assists professionals to meet the increasing demand for a qualified workforce especially as the industry is dynamic and ever-changing. Quantity surveyor professionals who fail to meet M&E standards will not meet employer satisfaction (Sawalhi and Enshassi, 2004; Zakaria, Munaaim & Khan, 2006). Therefore, to equip young graduates with the key skills and knowledge needed, it is important to determine new strategies for influencing the competencies of QSs' intellectual performance and educational outcome (Unit, 2015). One of the most basic skills of the young graduate is the quantification of M&E works which could be improved through well-planned educational training. It was opined that the current method of teaching and learning could provide potential graduates with better knowledge and skills that meet the industry and the employer's needs (Klosters, 2014).

Besides, Ewuga and Moluwu (2015) and Yusuf, Adebiyi, and Salami (2015) noted that training and retraining of QS in mechanical and electrical services are most important in making QS aware and ready in adopting renewable energy technology for buildings in Nigeria. Ebekozien (2014) stated that organizing external seminars and courses in collaboration with professional institutions and higher institutions was stated as a way to enhance the measurement of electrical installation. Ebekozien (2015) said that senior colleagues should take the bull by the horn in training young QS graduates in the measurement of electrical installations in preparing the bill of quantity. When there is a cordial relationship between the senior and junior or upcoming quantity surveyors there will be ease in learning. The young QSs must be inquisitive to learn from senior colleagues on how to effectively manage M&E services.

Quantity surveying educational systems should be reviewed and revised to enable them to meet industry expectations, by ensuring that all expected competencies are sufficiently addressed in their respective curricula (Chua, 2004). Quantity surveying education must cater to industry needs, to produce graduates who can face competition from their colleagues, and meet industry expectations. Therefore, national and international professional organizations should focus on and develop a qualitative system that can indicate the level of competencies required from their graduates (Yogeshwaran et.al, 2018). This system should be practicable and applicable for use by educational institutions when they evaluate their degree programs.

Furthermore, the Nigerian Institute of Quantity surveyors must review the academic curriculum in institutions to know areas that are lacking in the training where institutes can organize seminars and conferences to complement those weak areas (Olawumi and Ayegun, 2016). Olawumi et al., (2016) affirmed that this applies to the academic institutions and National University Commission (NUC) in collaboration with NIQS in ensuring they address lacking areas in the academic program. This will enhance the introduction of appropriate subjects/courses within the syllabus in tertiary institutions. Also, collaboration with other stakeholders to better understand the design and technology of building services in different organizations where young graduates QSs find themselves (Ewuga and Moluwu, 2015).

The industry expects graduates to improve their performance by going beyond the confines of the curriculum of their degree program and making themselves available for future improvements (Yogeshwaran et. al, 2018). The quantity surveying educational institutions, on the other hand, focus on producing graduates who will be able to cater only to present-day needs. New opportunities and developments in the industry reinforce the need to upgrade the competencies of graduate QSs to prepare them to face the threats and challenges of the industry.

Mohd Shafiei and Said (2008) noted that university educators should develop comprehensive course syllabuses that cover the whole spectrum of knowledge/cognitive, functional, and behavioral competencies to produce competent and employable QSs for the nation. Furthermore, when a comprehensive syllabus has been developed especially in the area of building services there must be a versed and experienced lecturer in teaching those courses. The Board of Quantity surveyors in Malaysia affirmed that quantity surveyor educators are to educate, train and produce graduate quantity surveyors who are competent, creative, and versatile

3. METHODOLOGY

This research adopted a mixed-method approach using a qualitative and quantitative method. For the quantitative method, questionnaires were used to elicit opinions from experts in mechanical and electrical services. Before that, a pilot study was used to pretest research instruments to help us understand whether the questions asked are not in rhetorics and are very appropriate (Dada, 2012). The pilot study was conducted with known experts who examine the questionnaire and correct errors before the larger survey. These experts consist of one (1) mechanical engineer, two (2) Quantity surveyors, and two (2) electrical engineers which altogether makes 5 experts. These experts were purposively selected which are known professionals in the Lagos state. After the pilot study, the known professionals in M&E services directed us to unknown professionals which is known as snowballing technique. Questionnaires were distributed to 168 identified professionals. 144 questionnaires were retrieved but 122 questionnaires were suitable for analysis. The other 22 respondents which were not used didn't complete the questionnaires and some were not well filled based on the judgment of the researcher. The respondents comprise 68 quantity surveyors, 24 Mechanical Engineers, and 30 Electrical engineers. This accounts for 73% of the response rate of respondents which is far beyond the 60% of questionnaire surveys suggested by Fincham (2008).

The mixed research design was used for this study where questionnaires were distributed to identified experts in M&E services working in M&E engineering and some consulting firms. This was conducted to elicit information in the study area. The sampling techniques used are purposive and snowballing sampling techniques in distributing to individuals in the firms. Purposive sampling was based on the judgment of the researcher in distributing the questionnaire for a pilot study. The snowballing technique was used because the sampling frame is difficult to establish and the technique was based on the premise that unknown respondents are identified through known respondents. Atkinson and Flint (2001) noted that Snowballing is an answer to hidden/concealed respondents.

Regarding the questionnaire, it was designed in different sections, respondents' demographic information was retrieved in the first section which includes their years of experience, profession, the number of projects engaged, academic qualification, and the number of M&E projects handled. The other part that is concerned about strategies to enhance competencies in the cost management of M&E services was collected from the respondents. The five-point Likert Scale was used as the basis for ranking the level of significance in which 5 represents Strongly Agree, 4 denotes

Agree, 3 connotes Indifferent, 2 represents Disagree, 1 denotes Strongly Disagree. The data collection was conducted within two and a half (2½) months which was through self-administering to respondents and electronic means. Mean Item Score, Bar chart, Standard deviation, Gap analysis, and Kruskal Wallis test was used in analyzing the retrieved data. The Background information of professionals was analyzed through the Bar chart, an average of the responses of professionals were analyzed by Mean Item Score (MIS). Variability or disparity in the responses of professionals was revealed by the standard deviation. A gap analysis was used to compare the current or actual state and the expected or desired state. Spearman correlation test was used to examine the relationship between importance and performance skills. Kruskal Wallis test was used to know the differences in the opinions of professionals.

Cronbach's alpha test was used in this research to test the reliability and validity of items in the questionnaire. Alpha (α) can be interpreted as a correlation coefficient that ranges from 0 to 1. The Cronbach's alpha was computed to test the reliability of the 5-point Likert scale for this study. For the strategies to enhance cost management of M&E services the reliability test was 0.807 which means that the degree of reliability of the instrument is more perfect (Moser and Kalton, 1999). Therefore, it can be deduced that the instruments employed for this research are significantly reliable.

Concerning the qualitative aspect, a semi-structured interview was conducted with selected Quantity surveyors based on ten (10) years of experience and have handled over twenty (20) M&E projects this was based on their vast experience to gather some vital information. Open questions were put forward to these experts to get more detailed information. Three (3) Quantity surveyors met the selection requirements which were interviewed to support the questionnaire filled by a professional expert in M&E services. The background of these Quantity surveyors were shown in table 1.

Table 1. Background of Interviewees of Quantity Surveyors experts in M&E works

Interviewees	Position	Experience (in years)	Number of M&E projects handled	Firm
1	Principal Quantity surveyor	18	42	Consulting firm
2	Senior Quantity surveyor	11	25	Contracting firm
3	Senior Quantity surveyor	13	31	Contracting firm

4. RESULTS AND DISCUSSION

From figure 1, the quantity surveyors represent more than 50% of the population, electrical engineers represent 24.6%, and mechanical engineers connote 19.7% of the respondents. 26.2% represents those that work in consulting firms while the remaining 73.8 percent work in the M&E contracting firm. The sex of respondents of the male is 92 which is 75.4% of the population while the rest represent the female Also, 21.3% of the population have HND, 57.4% of the respondents have B.Sc/B. Tech while the remaining holds M.Sc/M.Tech in their various profession.
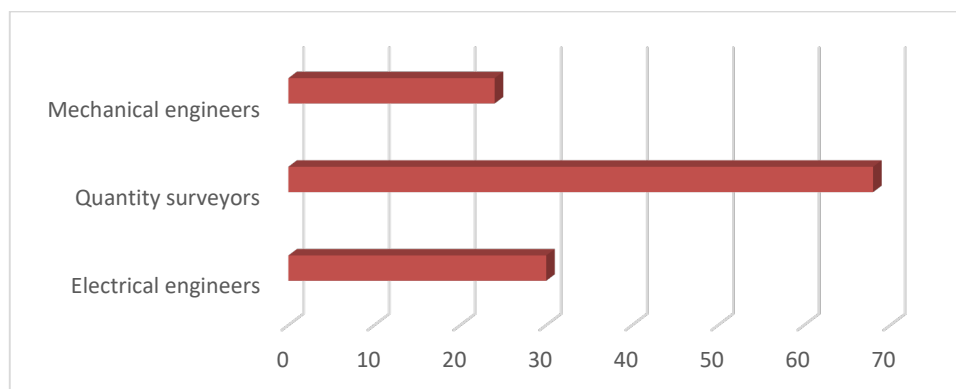

Figure 1: Profession of the respondents

In figure 2 the year of experience shows that those with a range of 1-5 years were 37.7%, 6-10 years' experience was 54.1%, 6.6% represent those within 11-15 years, and those above 20 represent 1.6%. The number of

M&E projects handled by each profession, 21.3% have handled 1-5 number of M&E projects. 6-10 M&E projects were 27.9%, 6.6% of the population belongs to 11-15 numbers of executed projects while those above 20 numbers are 39.3%. Furthermore, 72.1 percent connotes that is a member of their various affiliation, corporate was 19.7 percent and 8.2% belong to associates. Lastly, based on the findings above this can be affirmed that the data provided by the respondents are reliable.
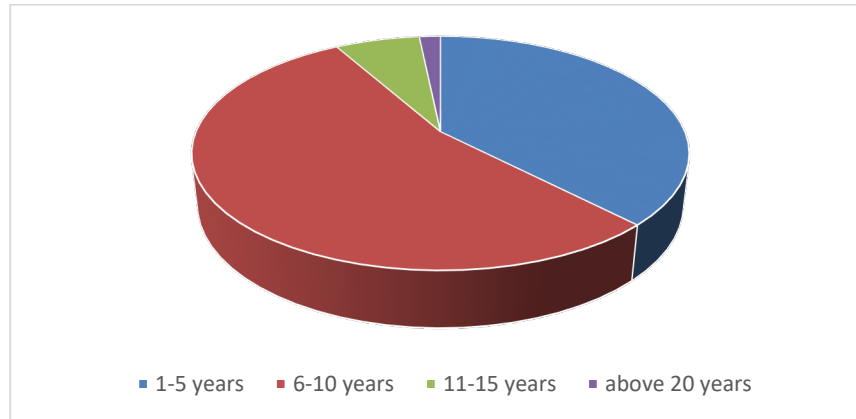

Figure 2. Years of experience in the industry

Table 2 shows the strategies in improving QS competencies in the cost management of M&E services. It was shown that site exposure of QS to M&E works having a mean value of 4.62 and SD of 0.582 is the most important aspect that QS must engage to be competent in managing M&E services. The second-ranked variable was advanced educational training of M&E services with a 4.56 mean value and SD of 0.646. The curriculum should be updated to multidimensional needs and the expected standard for M&E works was ranked third with a 4.54 mean value and SD of 0.594. Also, allowance of QS to get experience on the job (Mean of 4.51 and SD of 0.566); Versed and Experienced Lecturers should be allowed in the measurement of M&E services in institutions (Mean of 4.46 and SD of 0.787) was ranked fourth and fifth respectively. The least ranked strategy to improve competencies of QS was the provision of ICT in an organization having a mean value of 3.79 and SD of 0.635.

Table 2. Importance of the Strategies to Enhance QSs Competencies

Strategies	Mean	Std. Deviation	Rank
Site Exposure of quantity surveyors to M&E works	4.62	0.582	1
Advanced Educational training of M&E services	4.56	0.646	2
Curriculum should be updated to multidimensional needs and expected standards for M&E works	4.54	0.594	3
Allowance of QS to get experience on the job	4.51	0.566	4
Versed and Experienced Lecturers should be allowed in the measurement of M&E services in institutions	4.46	0.787	5
QS should engage in Research and Development	4.31	0.696	6
Team Development of QSs in an organization	4.30	0.558	7
Career development by individuals	4.21	0.661	8
Constant seminar and conferences for QS on M&E services by the professional body	4.15	0.654	9
Cordial Mentee and experienced Mentor relationship for M&E services on job/site	4.10	0.831	10
Provision of ICT in an organization	3.79	0.635	11

Kruskal-Wallis test was carried out to know the difference in the opinions of the professionals. The result of the test shows that only one (1) out of eleven (11) have asymptotic significance values of 0.05 and above. The null hypothesis which states that there is no significant difference in professionals' perceived strategies to improve QSs competencies was accepted while the alternate hypothesis was rejected. The only variable that is above 0.05 is the curriculum should be updated to multi-dimensional needs and the expected standard for M&E services. This means the professionals have converging ideas on the update of the curriculum to industry standards. The remaining ten

strategies have a *p-value* of less than 0.05 which denotes that there is a significant difference in the opinions of the professionals which makes the alternate hypothesis accepted while the null hypothesis was rejected. The ten strategies are advanced educational training, site exposure of QS, QS should be allowed to get experience on the job, career development, research and development, team development, provision of ICT, constant seminar and conferences, versed and experienced lecturers, and cordial mentee and mentor relationship.

Table 3 revealed the gap analysis result on the difference between the opinion of QSs and other professionals on the strategies in improving QSs competencies of M&E services. The following strategies have the largest gap values which include Constant seminar and conferences with 0.85 gap value, Research, and Development having a gap value of 0.66, Provision of ICT in an organization with 0.63, cordial mentee, and mentor relationship with 0.59, and team development with 0.53 gap values. This implies that QSs and other professionals have a significant difference in opinions on the strategies to enhance the competencies of QSs. The last two skills with the lowest gap values are versed and experienced lecturers, and career development by individuals having a gap value of 0.31 and -0.26 respectively. The last part that talks about career development by individuals have a negative sign because the views of other professionals are higher than the rating of QSs. This means that the other professionals believe that career development by individuals is vital to improving strategies compare to QSs.

Table 3. Test on the Strategies to Enhance QSs Competencies in Managing M&E

Strategies	Mean Item score				Kruskal -Wallis test		
	QS	Mech.	Elect	AMOP	Gap	Chi-square	Asymp. Sig.
Advanced Educational training of M&E services	4.74	4.41	4.27	4.34	0.40	10.265	0.006*
Site Exposure of quantity surveyors to M&E works	4.85	4.58	4.13	4.36	0.49	14.563	0.001*
Allowance of QS to get experience on the job	4.71	4.17	4.33	4.25	0.46	10.386	0.006*
Career development by individuals	4.12	4.75	4.00	4.38	-0.26	10.745	0.005*
QS should engage in Research and Development	4.59	3.58	4.27	3.93	0.66	15.255	0.000*
Team Development of QSs in an organization	4.53	3.92	4.07	4.00	0.53	13.705	0.001*
Provision of ICT in an organization	4.06	3.33	3.53	3.43	0.63	14.832	0.001*
Constant seminar and conferences for QS on M&E services by the professional body	4.53	3.75	3.60	3.68	0.85	26.487	0.000*
Curriculum should be updated to multidimensional needs and expected standards for M&E works	4.71	4.50	4.20	4.35	0.36	5.965	0.051
Versed and Experienced Lecturers should be allowed in the measurement of M&E services in institutions	4.62	4.75	3.87	4.31	0.31	9.848	0.007*
Cordial Mentee and experienced Mentor relationship for M&E services on job/site	4.38	4.17	3.40	3.79	0.59	12.904	0.002*

*p-value is significant at < 0.05
  Note: **QS** *(Quantity Surveyors),* **Mech.** *(Mechanical engineers),* **Elect** *(Electrical Engineers), and* **AMOP** *(Average mean of other professionals)*

Table 4. Interview Conducted to QSs Experts in M&E services on Strategies to Enhance Competencies for Cost Management of M&E Services

	Interviewee 1	Interviewee 2	Interviewee 3
Is the educational training adequate to inculcate skills and competencies expected?	Yes	Yes	No

Is there anything lacking for QS educational training in the cost management of M&E services?	Lack of site exposure	Nothing is lacking	Lack of exposure to M&E installation methods and measurement
Is the workplace/organization adequate to build/develop the skills/competencies needed?	Yes	Yes	It depends on the organization but personal training is important
According to experience, what do think reduces the competencies of QS to manage M&E services?	Lack of knowledge and skills	Lack of proper update on skills and career networking	Lack of update
How can the competencies be improved especially for young graduates?	Site exposure and training	Training related to M&E services	Career development and mentorship

The findings show ways to enhance QS competencies which revealed that site exposure of QS to the job, advanced educational training, and curriculum should be updated to the multi-dimensional needs of clients are the top three rated strategies. This is in line with Ebekozien, Nwaole, and Duru (2015) who stated that QS should be trained and retrained in electrical work measurement. This also corroborates with Klosters (2014) and Yusop, Derus, Bakari, Saberi, and Abdullah (2018) who opined those skills and knowledge of quantity surveyors could be improved through well-planned educational training. When teaching and learning adapt to the current method potential graduates will get better knowledge and skills that meet the industry and employer standards and needs. This implies there must be continuous training to update what has been learned because the needs of clients change per time and the product used might be different. Ebekozien et al., (2015) also reiterated that senior colleagues who are experienced should take the bull by the horn which is partially consistent with my findings which says cordial mentee and mentor relationship should be engaged.

This finding is consistent with Perera (2011) who stated that quantity surveying education has failed to identify the multi-dimensional needs of the client which has made them fail to reach the expected standard. This implies the education system is not meeting the expected standard met for the quantity surveyor to function at full capacity. This has made employers be dissatisfied with the level of their performance (Zakaria, Munaaim & Khan, 2006). This means that the institutions must cater to the industry to produce quantity surveyors who can face challenges and meet the industry expectations. In addition, the quantity surveying educational systems should be reviewed and revised to enable meet the industry expectations by ensuring all knowledge areas for effective management of M&E services should be addressed properly in the curriculum. In table 4, an interview was conducted with three Quantity surveyors. They affirmed that the educational training is adequate to inculcate the skills and competencies expected. Only one of the quantity surveyors said it is not adequate and said more training is needed and exposure of QSs to the clients' taste/need in M&E services. It was opined by interviewees that lack of exposure to the M&E services installation process and measurement is the main thing lacking in QSs educational training in managing M&E services. This is in alignment with the rating in the above on strategies to improve QSs competencies in table 2. In the course of the interview, the quantity surveyors noted that those that work in M&E firms or QS firms that are experts in M&E installation have been able to build their skills and competencies to the level required or expected because there is a gap between the educational training and industry expectations.

The interviewees said that QSs competencies are been reduced despite the fact they have been trained in the institutions because most companies in Nigeria are into civil and building construction, it is only a few companies that are into M&E services. Only those employed in M&E companies become more competent. Also, it was noted that the lack of proper updates on knowledge, skills, and career networking was part of those things that reduce their competencies. It was opined those competencies can be improved especially for young graduates' when there are training and seminars that are related to M&E services using the latest Building and Engineering Standard of Measurement (BESMM) that will update their knowledge and be of great benefit. Furthermore, it was also said that mentorship is very essential in teaching young graduates and the individual should be ready to develop themselves in their career.

5. CONCLUSIONS AND RECOMMENDATIONS

It was discovered that the strategies to enhance Quantity Surveyors' competencies in cost management of M&E include Site Exposure of quantity surveyors to M&E works; Advanced Educational training of M&E services and Curriculum should be updated to multidimensional needs and expected standard for M&E works. The implementation of this will bridge the knowledge gap between educational training and industry expectations. This

will also improve the competencies of QSs in the cost management of M&E services. Though updating of QS curriculum to the expected standard for M&E works was rated third, there was no significant difference of professionals on the variable. This means that there is converging opinion in the view of professionals about reviewing curriculum to be industry standard and expectations.

Furthermore, the interviewers made emphasis on the mentorship of young graduates moving into the industry especially in M&E services. There is also a need for academic institutions and professional bodies to update curriculum to the multi-dimensional needs of clients and standard of measurement so that graduate QSs will be able to face the challenges and threats in the industry. This will give graduate QSs confidence in applying to mechanical and electrical firms to sharpen their capability and improve their efficiency more in the cost management of the M&E project. Further studies can be conducted on civil and heavy engineering in developing countries.

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