

Overview of the Implementation of Quality Management System in Facilities Management

Hadzmedi Mohamad

Department of Real Estate
Universiti Teknologi Malaysia
Johor Bahru, Johor, Malaysia
hadzmedi@gmail.com

Mat Naim B Abdullah Mohd Asmoni

Centre of Quality and Risk Management
Universiti Teknologi Malaysia
Johor Bahru, Johor, Malaysia
matnaim@utm.my

Mehran Doulatabadi

MBA Centre
Xiamen University, Malaysia Campus
Sepang, Selangor, Malaysia
duolat@xmu.edu.my

Abstract

Facilities management (FM) is defined as an integration of facilities and services through people, process, place and technology in order to support and enhance the core business of an organization. Since business sustainability is depend on the customer, it is worth for FM organization to implement quality management system (QMS) that focus to achieve customer's satisfaction. However, FM organizations have yet to take full advantages and benefits of implementing QMS. This paper attempts to review the performances and issues related to FM organization that prompt them to implement QMS. The review also suggests gap in the previous research where future studies could be explored in the area of QMS implementation in FM organization.

Keywords

Facilities Management, Quality Management System

1. Introduction

Facilities management (FM) is a term that covers a wide range of activities comprised in the effective management of built assets. It involves the complete management of all services that support the fundamental business of the organization (Dilanthi Amaratunga et al. 2000). The International Facility Management Association (IFMA) defines FM as "A profession that encompasses multiple disciplines to ensure functionality of the built environment by integrating people, place, processes and technologies".

The continuation of active FM may assist to identify possible problems with maintenance and operation expenses before they result in component breakdown and even temporary shutdown of buildings (Dilanthi Amaratunga et al. 2000). It can provide a closely controlled framework for the examination of the relationships between decisions and the satisfaction of the end user of the property, whether in economic or environmental terms. This apparently provides that FM is an umbrella term under which, a wide range of property and user related functions may be brought together for the benefit of the organization and its employees as a whole (Dilanthi Amaratunga et al. 2000).

It is the role of the FM to coordinate and oversee the safe, secure, and environmentally-sound operations and maintenance of these assets in a cost-effective manner aimed at long-term preservation of the asset value, and also other janitorial duties such as making sure the environment is properly cleaned and sanitized for its tenants. In those cases where the operation of the facility directly involves the occupants and/or customers of the owner organization, the satisfactory delivery of facility-related services to these people will be an important consideration too; hence, the term "end-user satisfaction" is often used both as a goal and a measure of performance.

An important feature of FM is that it takes account of human needs of its tenants in the use of buildings and other constructed facilities. FM is performed during the operational phase of a building's life cycle, which normally extends over many decades. Since FM is the service provided to the users therefore, it is interrelated with user's satisfaction. Thus, the quality of FM should be considered in order to satisfy the need and expectations of the users.

Quality is defined as the total composite product and service characteristics of marketing, engineering, manufacture and maintenance through which the product and service in use will meet the expectation by the customer (Feigenbaum, 1991). Hence, customer is someone who will receive the product or service and the supplier is someone who supplies product or service. In line with this, FM service should be free from defects, deficiencies and significant variations in order to satisfy the users' needs and expectations. However, in order to implement a quality in FM, well prepared procedures are required. One of the ways to implement quality in FM is through QMS.

QMS is defined as all activities of the overall management function that determine the quality policy, objectives and responsibilities, and implement them by means such as quality planning, quality control, quality assurance, and quality improvement within the quality system (MS ISO 8402, 1994). QMS is a common name applied to all quality systems such as Total Quality Management (TQM), Kaizen, and the well-known ISO 9000 quality standards. This research however, focused on the ISO 9000 QMS.

ISO 9000 provides the requirements for QMS which is a framework for an organization to control its processes in order to achieve objectives including customer satisfaction, regulatory compliance and continual improvement. ISO's rules for the development of standards require their periodic review to decide if they need revising, maintaining or withdrawing. Many companies invest great efforts into achieving appropriate organization and through it better quality of products and services. They try to achieve this in a systematic way following the ISO 9000 standard.

As regard to above, FM is the services provided to the user of the properties and where else, quality is the user's satisfaction. QMS is the procedures, processes or plans needed to implement quality. Hence, QMS in FM is defined as the processes and procedures involved to control FM activities in order to achieve customer satisfaction.

1.1 Objectives

This paper attempts to review the performances and issues related to FM organization that prompt them to implement QMS. The review also suggests gap in the previous research where future studies could be explored in the area of QMS implementation in FM organization.

2. Literature Review

Facilities management (FM) previously has been regarded as the poor relation within the real estate, architecture, engineering and construction professions. This is because it was seen in the old-fashioned sense of caretaking, cleaning, repairs and maintenance. Nowadays, it covers real estate management, financial management, change management, human resources management, health and safety, contract management, in addition to building and engineering services maintenance, domestic services and utilities supplies (Syahrul Nizam Kamaruzzaman et al., 2010).

According to Pillay (2002), the development of FM in Malaysia started in the second half of 1990s. The government has played a major role in the development of FM in Malaysia. In 1996, the government has privatized the non-clinical support services in the government hospitals to three FM companies. It was indeed the biggest FM contract by the government at that time. It also marked the starting of the new era of FM in Malaysia.

According to Syahrul Nizam Kamaruzzaman et al. (2010), Former Deputy Prime Minister of Malaysia, Datuk Seri Abdullah Hj. Ahmad Badawi, during the opening of the Kuala Lumpur 21 Convention and Exposition, in referencing the state of FM in Malaysia have emphasized that “unless Malaysian changes their mentality to become more aware of the need to provide good services and improve the upkeep of buildings, we will forever be a Third World country with First World Infrastructure”. Ruslan (2007) have stated that the key issue currently facing FM sector in Malaysia is the low service quality.

According to Hassan (2007), Chief Secretary of Government of Malaysia, despite the government commitment with the allocation of RM1.079 million (US\$306,012.47) for upgrading renovation, there is evidence of shoddy work and buildings falling into despair. In addition to this, the Head of Maintenance Sector, Public Works Department Jabatan Kerja Raya (JKR), Malaysia, Annie (2007) perceived that the standards of maintenance in government buildings are not up to the expectations. Ballesty (2007) pointed out that FM challenges include lack of recognition, education and training needs; professional status, career pathways, information standard, performance benchmarking, cost value versus value in service procurement and corporate and community contribution of FM. In this respect, FM service quality and best practices, for Malaysia, require greater emphasis, which will take time to be adopted by FM practitioners in Malaysia.

According to Kamaruzzaman and Zawawi (2009), it is a very challenging responsibility and task for FM organisation to achieve efficiency as it involves various elements that have their own objectives and goals. Based on the issues in FM described earlier, this section is divided into two parts; the first part reviews the literature regarding the low service quality in FM, where else the second part is on the failure factors for the implementation of FM.

2.1 Low Service Quality in Facilities Management

Hesham Magd (2003) has clarified that in order to compete in today’s turbulent competitive business environment and global economy, satisfying customers’ needs have become the main focus of organizations as a means of obtaining advantages and even survival. Many of these organizations strive to achieve customer satisfactions through changing their strategy towards emphasizing on quality products and services. According to Lai et al. (2009); Reed et al. (2000) and Carr et al. (1997), this emphasis on quality is not surprising, because achieving, enhancing and sustaining competitiveness is dependent on providing superior quality products and services to consumer.

Quality has emerged as a strategic competitive tool for organizational success (Yong and Wilkinson, 2002; Hansen, 2001). In a highly competitive marketplace, an organization can stay competitive by satisfying clients’ needs and requirements for quality (Sui Pheng Low and Hennie Faizathy Omar 1997). They also state that the constant demand for quality requires the implementation of a QMS. Furthermore, this competitive market place itself necessitated the implementation of a formal and internationally recognized QMS to raise productivity and quality to satisfy the clients’ requirements (Low and Omar, 1997) to ultimately retain and sustain the company’s competitiveness (Love and Li, 2000).

This circumstance has led to the practice of a number of quality philosophies and initiatives, such as Total Quality Management (TQM), Just-In-Time (JIT) and ISO 9000. According to Heras et al. (2002), literature suggests that the most popular quality philosophies are TQM and ISO 9000, however interest in TQM appears to be static, while ISO 9000 certifications have grown rapidly in recent years. This is because the ISO 9000 is focused on quality control system in general, “from the process of product design to process design and from production process to service-after-sale” (Motwani et al. 1996). As a result, considerable progress has been made toward managing and controlling quality through the implementation of ISO 9000 (Wayhan et al. 2002). In addition to this, Withers and Ebrahimpour (2001); Lee and Palmer (1999), disclosed that the ISO 9000 were found to be the most prevalent quality approaches used.

The ISO 9000 is a family of standards and guidelines on how to develop a QMS to manage the processes that affect the products or services (Quazi et al. 2002). It is the guidelines for any organization willing to establish or improve its QMS . Usually, when a company obtains the ISO 9001: 2000 certificate, its business partners will be more confident in its QMS (Stevenson and Barnes, 2001).

The adoption of QMS in organizations are also proven to be very important in order to improve the service provided to customers (Ian W. Hall, 1997) and satisfy their need and expectation in accordance with the requirements in ISO 9000 for the survival of an organization in a highly competitive marketplace. In addition, according to Hesham Magd (2003), a number of recent studies have examined the impact of ISO 9000 implementation on organizational performance and suggested that the adoption of the ISO 9000 justified in terms of many benefits associated towards its implementation.

Even though, the adoption of ISO 9000 has been worldwide, however, it is undeniable that more researches need to be done in this area covering all types of aspect and sectors. It is noticeable through literature that some researchers investigated the “pros” and “cons” of the certification process (Stevenson and Barnes, 2001) or how the ISO 9000 helped companies in their total quality management (TQM) journey (Magd and Curry, 2003; Sun, 1999). Other authors studied the financial performances of the certified firms (Chow-Chua et al, 2003; Haversjo, 2000; Tsekouras et al, (2005); Wayhan et al, 2002). According to Hesham Magd (2003), a number of recent studies have examined the impact of ISO 9000 implementation on organizational performance and suggested that the adoption of the ISO 9000 justified in terms of many benefits associated towards its implementation.

Van der Wiele et al, (2005) provided an interesting classification of the research on ISO 9000. They discovered six major issues, namely:

- a) The relationship between ISO 9000 and TQM
- b) Perceptions about the benefits of ISO 9000
- c) The relationship between ISO 9000 and organizational improvement
- d) The usefulness of ISO 9000 for different sizes and types of organizations
- e) The long-term effects of ISO 9000
- f) The motivation to implement ISO 9000

Apart from the issues discovered by Van der Wiele et al, (2005), through literature regarding ISO 9000, it has been found that most research in the recent years have been done on seven main issues. Some of the issues which are found to be identical are grouped into one category and the issues with examples of articles are as follows:

- a) Effectiveness of ISO 9000
 - i) Relationship of ISO 9001:2000 quality system certification with operational and business performance: A survey in Australia and New Zealand-based manufacturing and service companies (Mei Feng et al, 2007)
 - ii) ISO 9000 and the U.S. Construction Industry (Abdol R. Chini and Hector E. Valdez, 2003)
- b) Perception towards ISO 9000
 - i) ISO 9000 standards: perceptions and experiences in the UK construction industry (Ramin Moatazed-Keivani et al, 1999)
 - ii) ISO 9000 and beyond: from a Hong Kong construction perspective (Mohan M. Kumaraswamy & Sunil M. Dissanayaka, 2000)
- c) Evaluating outcomes from ISO 9000
 - i) Evaluating outcomes from ISO 9000-certified quality systems of Hong Kong constructors (S. M. Dissanayaka et al, 2001)
 - ii) An investigation of ISO 9000 adoption in Saudi Arabia (Hesham A.E. Magd, 2006)
- d) Successful implementation of ISO 9000
 - i) What industrial marketers need to know now about ISO 9000 certification: A review, update, and integration with marketing (Thomas H. Stevenson, and Frank C. Barnes, 2002)
 - ii) Software quality management and ISO 9000 implementation (Y. Helio Yang, 2001)
- e) Steps after ISO 9000 implementation
 - i) International Standards and Construction (Janet K. Yates and Stylianos Anifotos, 1997)
 - ii) An investigation of ISO 9000 adoption in Saudi Arabia (Hesham A.E. Magd, 2006)
- f) Preparation for ISO 9001:2000
 - i) Construction in Hong Kong: Success Factors for ISO9000 Implementation (K. S. Chin and T. W. Choi, 2003)
- g) Barriers in implementing ISO 9000
 - i) Overcoming barriers to sustainable implementation of the ISO 9001 system (S.X. Zeng et al, 2007)

ii) Implementation of ISO 9000 in a textile mill (Ashok Sarkar, 1998)

Table 1 shows these issues tabulated in accordance to the sectors, in which most of the researchers have investigated.

Table 1. Matrix of Issues and Sectors

Issue \ Sector	Effectiveness of ISO 9000	Perception towards ISO 9000	Critical factors for ISO 9000 implementation	Roadmap for ISO 9000 implementation	Steps after ISO 9000 implementation	Preparation for ISO 9001:2000	Barriers in implementing ISO 9000
Construction	✓	✓	✓	✓		✓	✓
Manufacturing	✓	✓	✓	✓	✓		
Marketing	✓	✓		✓			
Software	✓	✓	✓	✓			
Engineering	✓	✓		✓			
Textiles	✓	✓	✓	✓	✓		✓
Facility Management	✓		✓				

From the Table 1, it is undeniable that paucity of research on the process of implementing QMS in FM does exist. The issue on FM lies only on effectiveness and critical factors in implementing ISO 9000. As compared to the issues arose in the research, it reveals that research on roadmap in implementing ISO 9000 and perception towards implementing ISO 9000 have been done in other sectors but not in FM sector.

5.2 Failure Factors in the Implementation of Facilities Management

According to Moore and Finch (2004), although Malaysia has successful examples of the development of FM, the overall picture of FM development in Malaysia remains mixed signals. This is due to the fact that, general understanding and progress which is the key driver for development of FM are lacking. Eventually, these lead to the failure of successful development of FM. According to Ballesty (2007), there are several challenges that impede the development of FM, namely, lack of recognition, education and training needs; professional status, career pathways, information standard, performance benchmarking, cost value versus value in service procurement, and cooperate and community contribution in FM. Table 2 displays the failures found in the adoption and implementation of FM as according to Mustafa et al., (2008).

Table 2. Failures Factors in the Implementation of FM

No.	Failing Factors	Description
1	Tactical Failing	Inadequate performance standard Low maintenance of cleaning standards
2	Strategic Environmental Failings	Lack of building performance monitoring data Failure to anticipate the consequences of change Failure to understand the non-linear nature of building complexity Slow response of systems used
3	Tactical Cultural Failings	Responding slowly to complaints Ignorance job stress

		Failure to provide appropriate advise on design and planning based on overall performance
4	Strategic Failings	FM issues not prioritized Over reliance on automated systems used Flagging improvement due to lack in technical knowledge and background

Source: Mustafa et al., (2008)

3. Results and Discussion

Based on the above discussion, it is clear that, low level of service quality in FM as a result of building defects is admittedly due to the failure factors which inhibit successful FM implementation. In fact, there are several human related factors and management related factors which ultimately lead to building defects such as, ignorance and lack of knowledge; lack of training and skills; lack of motivations and care; defective documentation, poor communication; and unanticipated consequence of change (Pheng and Wee, 2001).

Ignorance and lack of knowledge can exist in the form of not knowing what to do or not knowing why it is done in a certain manner. Where else, lack of training and skill development affects the operational competency such that workmanship quality is reduced thus resulting in more building defects. Lack of motivational and care is the most frequently used label to describe human error in the cause of defects. According to Porteous (1992), defective documentation may be either due to inaccurate information or insufficient or missing information. Poor communication occurs due to existence of assumptions regarding knowledge and experience. Finally, unanticipated consequence of change which often occur in order to deal with work delay or work redone, may result in incompatibility which turns out to cause defects in buildings.

According to Pheng and Wee (2001), one method for effective reduction in building defects is implementing ISO 9001 QMS in FM. In fact, as discussed earlier in the discussion section, one method of improving building service quality is implementing QMS in FM. Consequently, referring to Table 1 above, research on the perception FM operators on implementing ISO 9001 in FM and the roadmap of implementing ISO 9001 in FM has so far been lacking especially in the FM sector compare to other sectors. It is important to determine FM operators' perceptions on ISO 9001 implementation to achieve commitment and cooperation among them for effective implementation of the identified roadmap of implementing ISO 9001.

4. Conclusion

Based on the discussion on the failure factors of implementing FM in building sector, it is indeed crystal clear that there are several failure factors which hampers successful implementation of FM. Therefore, despite the challenges, one alternate solution to successfully implement FM is to identify the critical success factors. In fact, a critical review on previous literature also revealed that a research on the critical success factors for successful implementation of FM has been so far lacking.

In line with this, the research propose suggestion for future research, firstly in identifying critical success factors for successful implementation of FM, secondly, identifying the perception of FM operators regarding ISO 9001 implementation in FM and finally, to develop roadmap of implementing ISO 9001 in FM.

References

- Amaratunga, D. and D. Baldry (2000). "Assessment of facilities management performance in higher education properties." *Facilities* **18**(7/8): 293-301.
- Ballesty, S. (2007). "Building information modelling for facilities management." project report by Co-operative Research Centre (CRC) for Construction Innovation, Queensland, Australia.
- Ballesty, S., J. Mitchell, et al. (2007). "Adopting BIM for facilities management: Solutions for managing the Sydney Opera House." Cooperative Research Centre (CRC) for Construction Innovation, Brisbane, Australia.
- Chin, K.-S. and T. Choi (2003). "Construction in Hong Kong: success factors for ISO9000 implementation." *Journal of Construction Engineering and Management* **129**(6): 599-609.

- Chini, A. R. and H. E. Valdez (2003). "ISO 9000 and the US construction industry." *Journal of management in engineering* **19**(2): 69-77.
- Chow-Chua, C., M. Goh, et al. (2003). "Does ISO 9000 certification improve business performance?" *International Journal of Quality & Reliability Management* **20**(8): 936-953.
- Dissanayaka, S. M., M. Kumaraswamy, et al. (2001). "Evaluating outcomes from ISO 9000-certified quality systems of Hong Kong constructors." *Total Quality Management* **12**(1): 29-40.
- Elyna Myeda, N., S. Nizam Kamaruzzaman, et al. (2011). "Measuring the performance of office buildings maintenance management in Malaysia." *Journal of Facilities Management* **9**(3): 181-199.
- Feng, M., M. Terziovski, et al. (2007). "Relationship of ISO 9001: 2000 quality system certification with operational and business performance: A survey in Australia and New Zealand-based manufacturing and service companies." *Journal of Manufacturing Technology Management* **19**(1): 22-37.
- Hansen, A. D., P. Sorensen, et al. (2001). Wind farm modelling for power quality. Industrial Electronics Society, 2001. IECON'01. The 27th Annual Conference of the IEEE, IEEE.
- Harvey, L. and D. Green (1993). "Defining quality." *Assessment & evaluation in higher education* **18**(1): 9-34.
- Hassan, M. H. (2007). "Building capacity in the life sciences in the developing world." *Cell* **131**(3): 433-436.
- Häversjö, T. (2000). "The financial effects of ISO 9000 registration for Danish companies." *Managerial Auditing Journal* **15**(1/2): 47-52.
- Helio Yang, Y. (2001). "Software quality management and ISO 9000 implementation." *Industrial Management & Data Systems* **101**(7): 329-338.
- Heras, I., G. P. Dick, et al. (2002). "ISO 9000 registration's impact on sales and profitability: A longitudinal analysis of performance before and after accreditation." *International Journal of Quality & Reliability Management* **19**(6): 774-791.
- Kumaraswamy, M. M. and S. M. Dissanayaka (2000). "ISO 9000 and beyond: from a Hong Kong construction perspective." *Construction Management & Economics* **18**(7): 783-796.
- Lai, F., M. Griffin, et al. (2009). "How quality, value, image, and satisfaction create loyalty at a Chinese telecom." *Journal of Business Research* **62**(10): 980-986.
- Lee, K. S. and E. Palmer (1999). "An empirical examination of ISO 9000-registered companies in New Zealand." *Total Quality Management* **10**(6): 887-899.
- Love, P. and H. Li (2000). "Overcoming the problems associated with quality certification." *Construction Management & Economics* **18**(2): 139-149.
- Love, P. E. and H. Li (2000). "Quantifying the causes and costs of rework in construction." *Construction Management & Economics* **18**(4): 479-490.
- Magd, H. (2003). "Management attitudes and perceptions of older employees in hospitality management." *International Journal of Contemporary Hospitality Management* **15**(7): 393-401.
- Magd, H. and A. Curry (2003). "Benchmarking: achieving best value in public-sector organisations." *Benchmarking: An International Journal* **10**(3): 261-286.
- Magd, H. and A. Curry (2003). "ISO 9000 and TQM: are they complementary or contradictory to each other?" *The TQM magazine* **15**(4): 244-256.
- MOATAZED-KEANI IV, R. and A. R. GHANBARI-PARSA SECHI (1999). "ISO 9000 standards: perceptions and experiences in the UK construction industry." *Construction Management & Economics* **17**(1): 107-119.
- Moore, M. and E. Finch (2004). "Facilities management in South East Asia." *Facilities* **22**(9/10): 259-270.
- Motwani, J. (2001). "Critical factors and performance measures of TQM." *The TQM magazine* **13**(4): 292-300.
- Nizam Kamaruzzaman, S. and E. Marinie Ahmad Zawawi (2010). "Development of facilities management in Malaysia." *Journal of Facilities Management* **8**(1): 75-81.
- Pheng Low, S. and H. Faizathy Omar (1997). "The effective maintenance of quality management systems in the construction industry." *International Journal of Quality & Reliability Management* **14**(8): 768-790.
- Pheng Low, S. and H. Faizathy Omar (1997). "The effective maintenance of quality management systems in the construction industry." *International Journal of Quality & Reliability Management* **14**(8): 768-790.
- Pillay, Y. (2002). "Voices of health policy makers and public health managers: Key themes." Published by the Health Systems Trust: 273.
- Porteous, W. (1992). "Classifying building failure by cause: New approach to identifying the causes of building failure avoiding involvement with issues of blame." *Building Research and Information* **20**(6): 350-356.
- Quazi, H. A., C. W. Hong, et al. (2002). "Impact of ISO 9000 certification on quality management practices: A comparative study." *Total Quality Management* **13**(1): 53-67.
- Reed, R., D. J. Lemak, et al. (2000). "Total quality management and sustainable competitive advantage." *Journal of quality management* **5**(1): 5-26.

- Reed, R., D. J. Lemak, et al. (2000). "Total quality management and sustainable competitive advantage." *Journal of quality management* **5**(1): 5-26.
- Ruslan, N. (2007). Campus facilities management experience. Proceeding of the National Asset and Facilities Management (NAFAM) Convention, National Asset and Facilities Management Development.
- Sarkar, A. (1998). "Implementation of ISO 9000 in a textile mill." *Total Quality Management* **9**(1): 123-131.
- Smith, G. F. (1993). "The meaning of quality." *Total Quality Management* **4**(3): 235-244.
- Stevenson, T. H. and F. C. Barnes (2001). "Fourteen years of ISO 9000: impact, criticisms, costs, and benefits." *Business Horizons* **44**(3): 45-51.
- Stevenson, T. H. and F. C. Barnes (2002). "What industrial marketers need to know now about ISO 9000 certification: A review, update, and integration with marketing." *Industrial Marketing Management* **31**(8): 695-703.
- Sui Pheng, L. and D. Wee (2001). "Improving maintenance and reducing building defects through ISO 9000." *Journal of Quality in Maintenance Engineering* **7**(1): 6-24.
- Tzelepis, D., K. Tsekouras, et al. (2006). "The effects of ISO 9001 on firms' productive efficiency." *International Journal of Operations & Production Management* **26**(10): 1146-1165.
- Van der Wiele, T., J. Van Iwaarden, et al. (2005). "Perceptions about the ISO 9000 (2000) quality system standard revision and its value: the Dutch experience." *International Journal of Quality & Reliability Management* **22**(2): 101-119.
- Wayhan, V. B., E. T. Kirche, et al. (2002). "ISO 9000 certification: The financial performance implications." *Total Quality Management* **13**(2): 217-231.
- Wayhan, V. B., E. T. Kirche, et al. (2002). "ISO 9000 certification: The financial performance implications." *Total Quality Management* **13**(2): 217-231.
- Wilkinson, I. and L. Young (2002). "On cooperating: firms, relations and networks." *Journal of Business Research* **55**(2): 123-132.
- Withers, B. E. and M. Ebrahimpour (2001). "Impacts of ISO 9000 registration on European firms: a case analysis." *Integrated Manufacturing Systems* **12**(2): 139-151.
- Wruck, K. H. and M. C. Jensen (1994). "Science, specific knowledge, and total quality management." *Journal of Accounting and economics* **18**(3): 247-287.
- Yates, J. K. and S. Aniftos (1997). "International standards and construction." *Journal of Construction Engineering and Management* **123**(2): 127-137.
- Yong, J. and A. Wilkinson (2002). "The long and winding road: the evolution of quality management." *Total Quality Management* **13**(1): 101-121.
- Zawawi, E. M. A. and S. N. Kamaruzzaman (2009). "Personnel characteristics of maintenance practice: a case of high-rise office buildings in Malaysia." *Journal of Sustainable Development* **2**(1): p111.
- Zeng, S., P. Tian, et al. (2007). "Overcoming barriers to sustainable implementation of the ISO 9001 system." *Managerial Auditing Journal* **22**(3): 244-254.

Biography

Hadzmedi Mohamad is a PhD student in the Department of Real Estate, Faculty of Built Environment and Surveying, Universiti Teknologi Malaysia. He has a BSc. (Hons) in Quantity Surveying, Universiti Teknologi MARA and Master in Asset and Facilities Management, Universiti Teknologi Malaysia. He is a registered Quantity Surveyor with Board of Quantity Surveyors Malaysia. He is currently run his own business in providing quantity surveying and also facilities management professional services.

Mat Naim Abdullah Mohd Asmoni has a BSc. in Quantity Surveying from University of Glasgow Caledonian, United Kingdom, Master of Engineering in Construction and PhD in Facilities Management, both from Universiti Teknologi Malaysia. His specialisation is in the area of Project Management, Facilities Management and Quality Management System. He is also a certified trainer for Safety Course and a Certified Quality Auditor. Prior to joining Universiti Teknologi Malaysia he was with the construction industry for 20 years working in various fields and positions such as quantity surveyor for consulting firm and contract manager for local and international construction companies. He had also served as a Manager at the Construction Industry Development Board Malaysia. He also had his own business in safety and quality in construction between 2001 to 2005. In 2006 he joined Universiti Teknologi Malaysia and currently an Associate Professor at the Department of Real Estate, Faculty of Built Environment and Surveying. At present he is also seconded as a Deputy Director at the UTM Centre for Quality and Risk Management.

Mehran Doulatbadi received a Bachelor of Science; double Master's Degrees in MQM and MEM, a Graduate Certificate in Research Methodology and Design from University of Wollongong, New South Wales, Australia and a PhD in Management. He had completed 2 years Post-Doctoral Fellowship. He had published more than 85 academic papers including books chapters in peer-reviewed international journals and leading international conferences. He serves as the Editorial Board member and Associate Editor/Reviewer for several referred academic journals. He has been actively involved in a number of academic-industrial and government agencies research projects in national and international levels in countries such as United States, Canada, Australia, New Zealand, United Kingdom, Singapore, Malaysia, India, Japan and UAE. He was nominated and received several awards for his research contributions including "the IEEE Outstanding Publication Award in 2012 and 2013", "the IEOM Best Paper Award in 2015 and 2018", "UOW Outstanding Alumni Award in Research and Innovation in 2016" and "the IEOM Outstanding Service Award in 2018" and "IEOM Fellow 2021".