Journal of Sustainability Science and Management
Volume 13 Number 2, December 2018
ISSN: 1823-8556

RECENT MODELS IN NEW GENERATION OF COST EFFECTIVE FACILITIES MANAGEMENT IN BUILDING

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Abstract: A major role of facilities management (FM) is to ensure the maintainability, usability and reliability of the asset being managed. To achieve this management, the last decade shows a growing attention to the concept of the added value of FM. The purpose of this paper is to identify, compare and describe the various FM models and investigate their value parameters in the context of FM research and practice. A comprehensive literature review of various journals was adopted to categorize the various conceptual models and investigate the major value parameters in establishing FM model. The existing eight conceptual models are explicated in the context of FM and revealed quite diverse parameters have been considered in the variant research projects and frameworks. This study is organizing 11-various value parameter in FM models into appropriate four headings: people, process and product, economy and social. Among all value parameters, the most prioritized value parameters are reducing cost and client satisfaction, followed by productivity. This paper findings are providing a sound foundation and practical understanding for future research to harmonize the concept of the added value of FM as it is based solely on reviewing literature.

Keywords: Facility management, models, parameters, building

Introduction

The principal focus of facility management (FM) has long time been on controlling and reducing the cost of physical asset and now changed towards the creating added value. FM has now given a focal core interest around the world to be more proficient and successful management activity, as competitive pressure is escalating on organizations (Fraser, 2014). Recently, researchers have shown an increased interest in the high value of building and facilities; both commercial and private customers of such facilities never admit reactive actions, however, expect a proactive approach. The past 15-20 years have seen increasingly rapid advances in the field of facilities maintenance management, recent evidence suggests that all business leaders are increasingly materialized their interest on "strategic and financial" importance of the maintenance function for all physical assets (Khazraei & Deuse, 2011).

Fraser (2014) highlighted maintenance cost possibly to be even higher in coming years with the advent of more expectations of client requirement in building design. However, these rapid growths of maintenance cost are having a serious effect on building operating cost and even researchers have consistently raised their concerns regarding drawbacks of this major issue based on empirical studies.

The effective integration of FM functions with engineering in design phase formed a central focus and found organization can be benefited in saving a huge amount of time and money from dealing with major concerns issue of maintainability (Katchamart, 2013). In the new global economy, many organization seeking and adopting the effective as well as a reactive approach rather than traditional for FM strategies (Jensen *et al.,* 2012). Any unexpected failure of building services is the cause of growing customer and society discontent around all community. So far, every day billions of people around the world depend on the reliability of facilities services purpose of work, pleasure or place of residence. This indicates a need to understand the various perception of FM as critical.

According to Katchamart (2013), the added value of facilities is more perceived as operational efficiency and effectiveness, end-user satisfaction and business profitability. In addition, Den Heijer (2011) and Riratanaphong (2013) provides three more different value such as productivity, profitability and cost efficiency. The limited number of research papers provide the literature as a guideline for model creation. Therefore, the objectives are set for this paper is to, first distinguish and categorize the various FM models in the literature. Finally, provide a list of key parameters to be found from literature analysis for model development. This finding will provide a sound foundation and practical understanding for future research to harmonize the concept of cost-effective FM practice.

Theory and Literature Review

The research topic of this paper is partly related to value creation and increase the value of core business for the profit of every single pertinent stakeholder. Adding value is completely viewed as a distinction between pure cost reductions, however, the connection amongst value and cost is entirely complex, and identify the major value-adding parameter is also a part of this paper.

The Concept of Added Value

Value as an idea has a wide range of implications and uses. There is a fundamental distinction between value in the singular, stating the worth of something, and values in the plural, that related to individual belief and social behavior. Jensen *et al.,* (2012). Reach a different conclusion, which is "use value" deals with the non-tradable asset, for example, knowledge, creative abilities, brands and facility concepts.

The added value can be characterized as the value of the product decreased with the value of the resources utilized amid the procedure and it is a relative concept that refers to change over time. Consequently, decreasing cost by intensifying efficiency. Added value just identifies the output and possibly concerns with the result of a procedure, nevertheless does not concern the procedure.

Following Figure 1 illustrates the difference between added use value and cost reduction. It demonstrates the relative enhancement over time of cost and uses the value of a service compared with a standard line called Service Level Agreement (SLA). The use value of the service can be measured with a minimum level of customer satisfaction. A cost reduction occurs, if the cost/price of the service over time goes down without lowering the customer satisfaction below the minimum level. Contrarily, an increase in use value will occur, if the customer satisfaction over time gets higher than the minimum level of customer satisfaction. This does not necessary involve a change in the SLA, but it means that added use value is created.

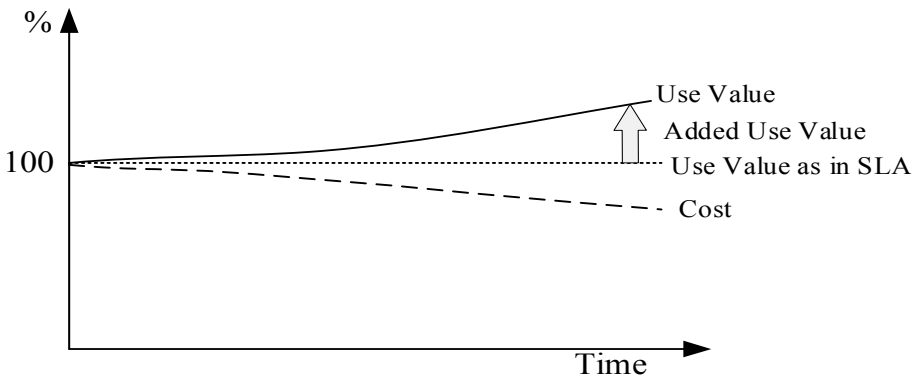

Figure 1: Relationship of added use value and cost reduction (adapted from Jensen *et al.* (2012)

Review of Existing FM Model in Literature

Over the past decade, most research in FM field has emphasized on measuring the added value parameters for successful model creation. The reason behind this: varying nature of work, increasing global competition, level of quality work and external demand. An extensive literature study on the fast-growing discipline of FM shows various models have been developed, grounded on Balance Scorecard (BSC), Business Excellence Model (BEM), Key Performance Indicator (KPI), and Capability Maturity Model (CMM), etc. Even though these models originate from various background, every one of them has made impressive progress for the enhancement of organizations' performance. This can be seen from different endeavors made by a substantial number of researchers and experts for the utilization of these models in their own fields.

Pit and Tucker (2008) reviewed the literature from the period and found little evidence, which is added value concept has made a great revolution in many fast-growing disciplines, including construction and FM. In contrast to earlier findings, however, Meng and Minogue (2011) who argue that added value concept in FM is still infancy and there is an absence of systematic research in the discipline of FM. Actually, in recent years, a considerable number of models have appeared for the specific areas in developed countries, whilst there have been few empirical investigations found in Malaysia. Therefore, this research attempts to show the comparison of various existing model parameters in FM practice that possibly assist to improve the FM organizations' performance in Malaysia.

In the history of development FM, added value parameters have been thought as a pinpoint concern in this industry. In the past two decades, few researchers have been able to draw a systematic research into this area, amongst in 1993 Nourse and Roulac was the first to discuss added value in FM, followed by Krumm (1999) and Joroff *et al.* (2003) discovered the added value elements of FM. However, in 2008 Lindholm draws attention all researchers in this field by implemented a theoretical model from balanced scorecard methodology, which nearly related with the elements discovered by Krumm and Jonge (1999). Prior to undertaking the investigation, Lindholm categorizes his findings related to added value elements of FM in following, increase the value of assets, innovation, customer satisfaction, efficiency, flexibility, and reduce cost.

The comparison of existing four models (BSC, BEM, KPI and CMM) and a comprehensive literature study in construction and FM are introduced and discussed in detail. In this discipline strong focus on controlling and reducing property cost, workspace related service and newly incorporated another term added value. This paper typically conceptual and attempts to identify the prevailing model in FM practice. Nonetheless, it is developed on a large scale of research and empirical evidence.

Balance Scorecard (BSC)

The first discussions and analysis of BSC emerged during the 1992s by Kaplan and Norton. Unlike the traditional approach, introduced four different perspectives: financial, client, business procedure, and knowledge and development to evaluate the business strategic goal. In another study David (2005) reported, it's aim is balancing the long-term and short-term objectives, financial with non-financial issues, furthermore internal with external environments. In the construction field, there is convincing number research showed the BSC has been adopted to assess the performance enhancement through the implementation of FM in construction organization (Meng & Minogue, 2011). Several researchers, such as Amaratunga and Baldry (2000), Bassioni et al. (2004) and Phadtare, (2010) already introduced this concept to generate a conceptual framework for measuring the performance of FM services, as illustrated in Figure 2. In another detailed investigation by Brackertz (2006) described six perspectives of facility performance elements: service, physical asset, community, financial, utilization and environmental. These six broad themes also emerged from the analysis of Meng and Minogue (2011) study.

Figure 2: Schematic diagram of Balance Scorecard (BSC) (adapted from Phadtare, 2010)

Business Excellence Model (BEM)

According to an investigation by Conti (2007), in 1990 the BEM was first discovered by European Foundation of Quality Management (EFQM). Research such as that conducted by Turner (2016) showed this model is developed on the basis of nine criteria and dealt with cause-and-effect relationship amongst enablers and consequences. Major criteria are financial, customer satisfaction, people satisfaction, impact on society, resources and process management. Especially in Europe, this model has been widely recognized to achieve the self-assessment and continuous development of the widespread organizations (Conti, 2007). Other analysts Meng and Minogue (2011) have attempted to draw the usefulness of such model and found the model gradually shifted the concept to more quality of management rather than total quality management, as shown in Figure 3. In recent years, there has been an increasing amount of literature on the BEM concept can be found in the fast-growing FM related sector, mostly in Europe Meng and Minogue (2011). The relevance of this model examples is in a different discipline, Stewart (2003) investigated in National Health Service (NHS), Politis (2009) presented in hotel sector and Schwarz *et al.* (2010) provided in sports facilities.

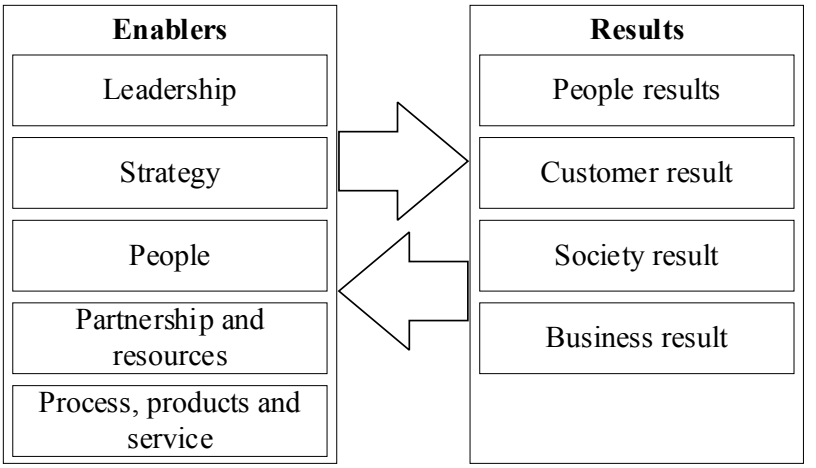

Figure 3: Business excellence criteria (adapted from Kauppila *et al.,* 2015)

Key Performance Indicator (KPI)

It is necessary to clarify exactly what is meant by KPI, Fitz-Gibbon (1990) was apparently the first to use the term who defines KPI as an indicator of performance measurement. According to a definition provided by Chan and Chan (2004), KPI is mostly concentrating on critical features of outputs or outcomes. Various industry increasingly adopted the KPI system. Traditionally, in construction industry topmost three primary performance indicators are time, cost and quality. The first KPI emerged during the 1999s in the UK construction industry which discussed many other critical factors, for example, safety, productivity, profitability, predictability and client satisfaction (Meng and Minogue 2011). According to a survey research in UK construction industry by Bassioni *et al.* (2004) identified over 26 percent leading firms adopted the most popular KPI-related model in professional practice. Recent evidence suggests that some researchers have been taken the initiatives to introduce the KPI methodology into the fast-growing FM disciplines. Loosemore and Hsin (2001) concluded that successful introduction of KPIs in FM can help to generate several advantages, such as concentrate on managerial effort, choose appropriate FM service providers, and monitored and controlled their desired outcome. Table 1 presents the key performance indicators relating to facility management services.

Table 1: Key performance indicators for facilities management (FM) services (adapted from Meng & Minogue, 2011)

Economic indicators	Social indicators	Environmental indicators
- Client satisfaction	- Qualifications of staff	- Environmental impact during the operation of the building
- Faults, repair, and replacement of small parts	- Health and comfort	- Water management of the building
- Cleaning and maintenance	- Safety/Protection	- Waste management of the building
- Operation and maintenance cost of buildings	- Satisfaction and skill	

Capability Maturity Model (CMM)

Chrissis *et al.* (2003) trace the development of CMM in 1991, first proposed by the Software Engineering Institute (SEI) of Carnegie Mellon University. It deals with process improvement of capability or maturity level for an organization. The CMM concept has been adopted into various sectors once achieved the success in the software industry. For example, Sarshar *et al.* (2000) have been established a diagnostic tool for improving the management procedure in construction organization. Several attempts have been made to introduce the CMM idea into the FM context which can be considered the extension of construction, however, Bassioni *et al.* (2004) revealed CMM-related models hardly adopted in FM practice. It has been demonstrated that CMM discussed the practicality and applicability in the FM environment (Figure 4)

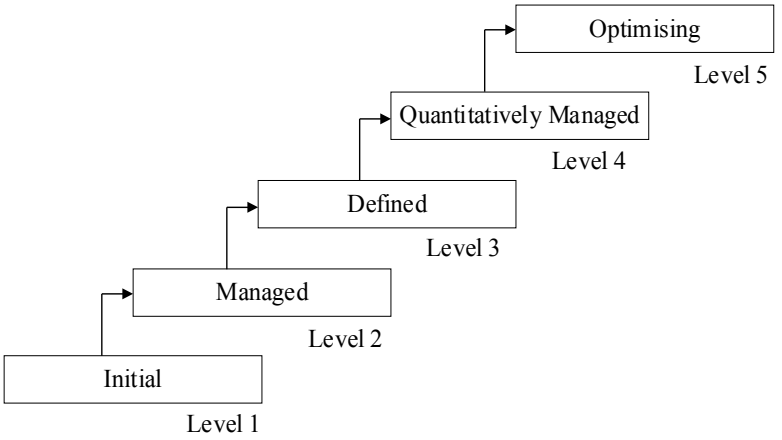

Figure 4: Schematic diagram of capability maturity model (CMM) (adapted from Amaratunga *et al.,* 2002)

In this discipline strong focus on controlling and reducing property cost, workspace related service and newly incorporated another term added value. Main characteristics of four popular models are summarized in Table 2. On the other side, these depicted characteristics are the main considering parameters for value-adding FM model creation.

Table 2: Main components of the model

	BSC	**BEM**	**KPI**	**CMM**
Objective	Reinforce the organization's operational planning	Describes cause-and-effect of an operational process	Focuses on critical aspects of outcomes/ outputs	Helps to improve current best practices of the organization
Main Focusing Area	- Financial - Customer satisfaction - Business process - Service - Community - Environmental	- Financial - Customer satisfaction - People satisfaction - Impact on society - Policy and strategy - Resources	- Cost - Quality - Safety - Productivity - Profitability - Customer satisfaction - Safe environment - Service reliability	- Capability - Maturity - Process management
References	Brackertz (2006); Phadtare (2010)	Turner (2016); Kauppila *et al.,* (2015)	Meng and Minogue (2011); Loosemore and Hsin (2001)	Sarshar *et al.* (2000); Amaratunga *et al.,* (2002)

As illustrated above in Table 2, the BSC, BEM, KPI and CMM covered multiple perspectives for measuring the FM parameters. For not choosing the appropriate criteria, measurement might be ineffective and mislead the performance. It is apparent from the Table 1 that among all of the three models commonly focused on the financial (cost-effectiveness), customer satisfaction, quality of service and environment. Interestingly, the capability, maturity and process management were observed in CMM only, though unlike other models, this is rarely practiced in FM industry. Building performance can be significantly improved through adherence to proper quality and project management practices. Love *et al.* (2013) asserted that a systemic model for reducing maintenance cost can be developed based on the realistic application of tools and techniques that are readily available within the building and FM industry.

Review of FM Conceptual Model

This study has concentrated on focusing area for FM practice. It appears from the investigations that numerous research has been conducted on the conceptual model development in FM practice, particularly in many developed countries, e.g. Netherland, Denmark, Germany, Hong Kong, etc. However, a very little attempt has been given great attention by the researchers in the past on this fast-growing discipline in Malaysia. This was the motivation behind the present study.

Generally, the term framework in FM practice embodies a multitude of concepts which includes a basic process in existing conceptual framework grounded on input → throughout → output. In the concept of FM practice input being resources of FM, followed by throughout is FM process and finally, the output is FM provisions. The FM provisions (output) can lead to various kinds of the outcome, i.e. impacts on added value parameters, surroundings and different shareholders. In the general process of the existing framework, the inputs are categorized into followings: human resources (HR), technology, information and capital (Jensen & Van der Voordt 2016). In the same time, De Vries *et al.* (2008) mentioned that it is hard to prove the cause-effect relationship due to impacts of many interrelated input factors and many ways of interventions. Furthermore, in most recent studies, Jensen and van der Voordt (2016) defines the general process of a conceptual framework for added value in FM practice as follows:

Input → Throughput → Output → Outcome → Impact = Added Value

In addition to work of Riratanaphong (2013) provides an elaborate influencing factors in the conceptual model, as shown in Figure 5, that describes the possible impact of organizational characteristics on organization's resources. It happens between input and output and outcomes of the organizations. Organizational manpower and practiced culture both have an effect on the choices of facilities to accelerate the work process for achieving the customer satisfaction. To achieve this satisfaction there are some contextual impacts such as the economy and traditional culture. Recent evidence suggests the previous view that by introducing a successful model framework in FM practiced organization can mitigate the complex contextual factor such as economic situation and operating environment (Goh *et al.* 2015).

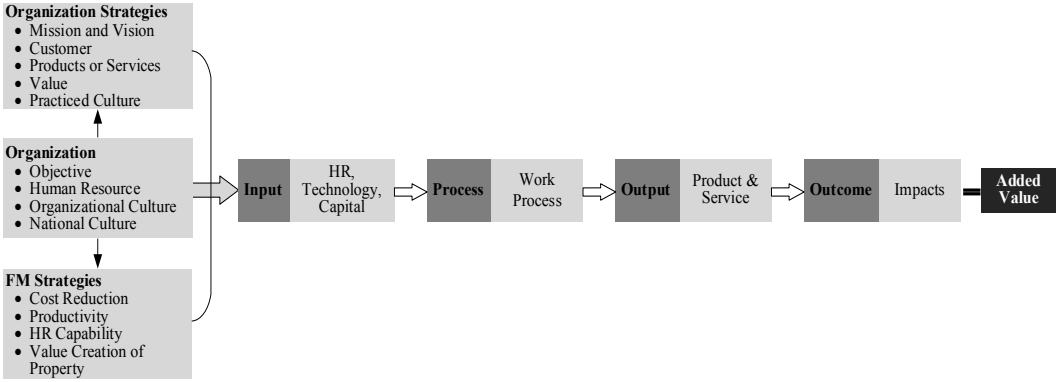

Figure 5: Influencing factors of added value (adapted from Goh *et al.,* 2015)

From the extensive literature study of the conceptual model, the value-adding concept is often included and discussed the various parameters. Table 3 illustrates the main parameters that were discussed in the various FM conceptual model.

Table 3: Identified various value parameters from Facility management (FM) model

Reference →	Lindholm (2008)	Van Meel *et al.* (2010)	Van der Zwart and Van der Voordt (2013)	Jensen *et al* (2012)	Jensen *et al.* (2008)	Lindholm and Aaltonen (2012)	De Vries *et al.* (2008)	Den Heijer (2011)
□ Category	A	B	C	D	E	F	G	H
People satisfaction	- Customer satisfaction	- Focusing on talented staff	- User satisfaction	- Satisfaction	- Satisfaction - Culture	- Satisfaction	- User satisfaction - Culture	- Users satisfaction - Culture
Financial condition	- Value of assets		- Finance position			- Value of assets		- Increasing asset value
Organizational development	- Flexibility - Innovation	- Interaction - Culture - Creativity	- Culture - Image - Innovation	- Adaptation - Culture - Reliability	- Adaptability - Reliability	- Innovation - Flexibility	- Image - Flexibility - Innovation	- Image - Innovation - Collaboration
Productivity	- Productivity	- Enhancing productivity	- Improving productivity	- Productivity	- Productivity	- Increase productivity	- Production	
Environmental responsibility		- Environmental impact		- Environmental	- Social - Environmental	- Environmental sustainability		
Cost efficiency	- Reducing cost	- Reducing cost	- Reducing cost	- Cost minimization	- Reduce cost	- Reduce cost	- Cost control	- Decreasing cost

Discussion

The result obtained from the preliminary analysis of FM models are summarized in Table 3. This table is quite revealing in several ways. From this table, we can see that all models consider the satisfaction parameter under the "people satisfaction" related category. Of the 8 models which analyzed on this research, 3 models C, G and H was very specific on "user satisfaction", in model A only reported on "customer satisfaction". Model E, G and H also include "culture", while model B is only focused on the "talented staff" under people satisfaction. As a result, people related design parameters are well accepted by most of the model as they have realized the significance of incorporation to FM model development. Obviously, a better understanding of the clients' objectives is the driving force in the practice of FM to improve the nature of building performance as analyzed by Katchamart (2013); van der voordt & Jensen (2014).

In another study, client desire has been most significant, but user desire has become increasingly significant day to day (van der voordt & Jensen, 2014). As Table 3 shows, just half of those models reported the parameter related to "financial condition" with slightly different names. The parameter "value of assets" can be seen under this category in model A, F and H. All 8 models observe no less than two parameters under "organizational development" with many overlaps. However, the differences can partially be observed as diverse degrees of sub-dividing. "Value of asset" is now considering an essential engagement in the building life-cycle for a reliable and cost-effective operation system, in addition ensuring the usability, reliability and safety of the assets being managed (Fraser, 2014). Therefore, FM experts seeking to expand their knowledge to develop a suitable FM model for enhancing cost-efficiency.

The single most surprising observation to emerge from the table that the parameter "culture" is defined in two different categories namely "people satisfaction" and "organizational development". As earlier mentioned three models name for the parameter "culture", others three models B, C and D also defined this parameter under "organizational development" category. Turning now to the "productivity" category, the most surprising observation in this category is the model H did not define any parameter related to "productivity", while the seven other models illustrate the parameter "productivity" with little wide-ranging names. Table 3 presents just 50% of the model indicated the environmental impact parameter under "environmental responsibility" category. Model E was the foremost to introduce this parameter, as well as the parameter "social". The more recent model B, D and F also adopt this parameter "environmental sustainability". The identification of this importance explains this parameter's integration in the development of FM model is highly significant to achieve the sustainability in building projects. Prior studies that have noted the importance of environmental impact, but it is still not acknowledged high priority in many buildings in terms of selection of environmental suitable materials (van der Voordt & Jensen, 2014).

The most striking result to emerge from the Table 3 is that the total number of models for this study agreed the parameter "reducing cost" under "cost efficiency" category with slightly different terms. Model G is only presented to some extent different name of the parameter called "cost control", indirectly this term is also referred the mostly viewed wide-ranging parameter "reducing cost". This indicates a common view amongst model that cost-effectiveness is the most prioritized parameters all kind of business organization in terms of capital investment, turnover and operational cost. Obviously, cost reduction is an important mean in building operational phase without regard to the harm being done to occupants' comfort and satisfaction as well as the global environment. Initial capital investment for building facilities is a major concern, however, now a day long-term cost impacts for built facilities are measuring and benchmarking in terms of affordability and sustainability (Turner, 2016).

From the Figure 6, bar chart graph illustrates the number of parameters considering in the model. It can clearly be seen that "user satisfaction" parameter was a considerably utmost priority as all model adopted this, similarly the "reducing cost" parameter also accepted as it is the goal of the organization. From the graph, it is apparent that except the single model, other models consider the "productivity" parameter. However, three parameters "value of assets", "innovations" and "environmental impacts" have the moderate effect on FM model creation as four models defined these parameters under a different category. Almost two-thirds of the models indicated the following four parameters namely "culture", "flexibility" and "image". Together these parameters provide important insight into a conceptual model of facilities management.

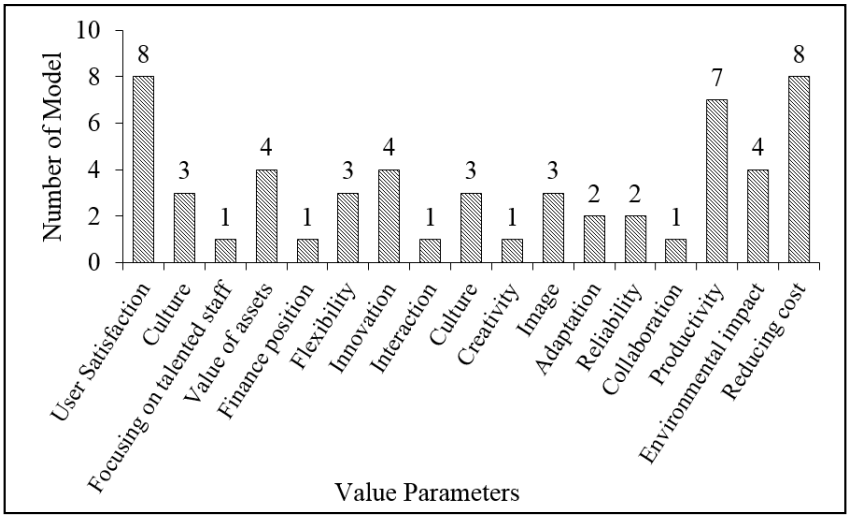

Figure 6: Parameters in each model

Based on the mentioned parameters in Table 3, the 11 value parameters are listed and organized in Table 4 with four headings. More or less all the value parameters in Table 3 are included from the comprehensive literature study of the FM model, however, the terms of the parameters have been synchronized. In addition, the parameter "health and safety" has been added under the people heading.

Table 4: Identified parameters in different group

Group	People	Process and Product	Economy	Social
Value Parameters	- Client and user satisfaction - Practiced culture - Health and safety	- Productivity - Design adaptability - Innovation and creativity - Risk management	- Cost-effectiveness - Value of asset	- Environmental impact - Responsibility

Approximately over half of the parameters identified in this study are quite similar to the past study Meng and Minogue (2013), e.g. client satisfaction, cost-effectiveness, health and safety, environmental impact, productivity and creativity. On the other hand, practiced culture, design adaptability and value of asset is acknowledged as the new value parameters in a conceptual model development of FM organizations (Jensen & van der Voordt, 2016). However, Mutalib *et al.* (2018), and Hsu and Sabherwal (2012) suggested the potential relationship among learning culture, customer performance, efficiency and innovation to develop a conceptual model in FM context.

This study findings contribute to the establishment of various FM models and the introduction of their concepts into the FM discipline in Malaysia as this fast-growing sector is very infancy here. However, the application of these existing models in reality is effective to analyze the real effect in the FM sector. In the case of practitioners, the emphasis on empirical evidence is important because it allows the model to be evaluated in a real-world environment, in addition provides an insight into the appropriate use of performance models as indicators. Moreover, this paper demonstrates the importance of developing a maintenance culture for those overseeing the management of facilities, it is now essential that a reliable maintenance system is in place to ensure the continued usability, reliability and safety of the assets being managed.

Based on the findings discussed in the previous section, a proposed model of FM was developed by integrating the potential value parameters in early design development stage to maximize the building performance in FM practices, as shown in Figure 7. The integration is shown in the proposed model clearly has not been studied in previous empirical research in the context of FM in Malaysia. This study hopefully can make a valuable contribution to the body of knowledge by studying this incorporation. This research is expected to bring a new dimension result from the perspective of the implication of value parameters in the various design stage. Secondly, the proposed model would assist the FM team in order to utilize their resources more effectively by reducing operation and maintenance cost. In addition, this model provides FM team with tools and resources that can assist them to promote sustainability in FM practices.

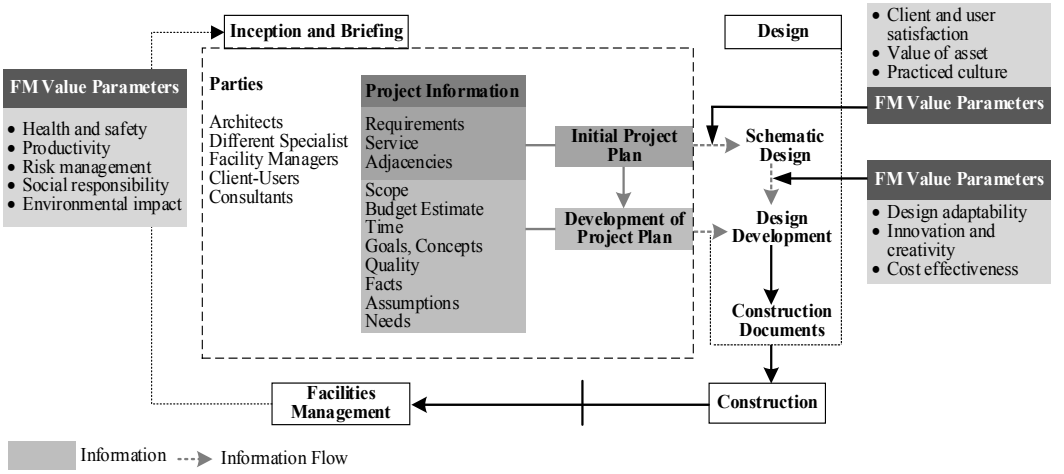

Figure 7: Integration of facility management (FM) value parameters into the design process

Conclusion

FM is a fast-growing discipline in all over the world, now it is imperative to build up the FM field from not only being able to deliver the similar services as before to a reducing cost but also to offer better services to their valued clients, customers and end users. An extensive literature review is carried out in this paper with an aim to determine the value parameters from the systematic summary of the established FM conceptual models in the last 10 years. Based on the literature study, the existing 8 conceptual models are observed in the context of FM and revealed quite diverse parameters have been considered in the variant research projects. These identified parameters have an enormous effect on conceptual model knowledge within FM. Comparison with KPI, BSC, BEM and CMM, the KPI is widely used by the FM professionals. One major development in this study is organizing the 11-various value parameter in FM models into appropriate four headings: people, process and product, economy and social. Among all value parameters, the most prioritized value parameters are reducing cost and client satisfaction, followed by productivity. The parameter reducing cost can be achieved through traditional management principles and methods. However, the term added value can only be obtained based on very precise knowledge and methods associated with this specific field of practice. Therefore, creation and development of a new conceptual model based on their specific research knowledge within FM practice and FM profession. The findings from this research such as the developed model, the FM team may identify the known deficiencies and skills gap to assist them to implement relevant education and training and to develop new mindsets and attitudes towards sustainability efforts. A major limitation is the small number of conceptual

model analyzed in the FM discipline. Obviously, all existing models are outlined for the specific industry with its own precise characteristics. However, FM is a discipline with its own specific characteristics. Therefore, Further study may be carried out to collect more empirical data so that greater reliability will be provided for the results of data analysis. In this respect, an investigation of successful bespoke performance measurement systems is worthwhile because it will provide referential experience in measuring and improving the FM performance.

Acknowledgements

The authors would like to thank PRGS # R. J130000.7811.4L692, UTM, Malaysia for the support and facilities that made this paper possible.

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