SUSTAINABLE FACILITIES MANAGEMENT (SFM): A REVIEW OF PRACTICES AND BARRIERS

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ABSTRACT

Practicing sustainability helps Facilities Management (FM) professionals to re-position themselves from traditional FM to strategic support function. However embracing sustainability is a challenging task as FM scopes are firm specific and integrating sustainable practices are puzzling. Yet, incorporating sustainability into FM practice has a great potential and FM professionals are identified at the forefront in delivering sustainability. However, only few FM professionals are able to embrace the sustainability concept into their operations due to various reasons such as; lack of capability, knowledge and skills, financial support and support from government being the major barriers as per theory. Hence, this paper focusses on identifying current FM scope with possible sustainable practices and explores the existing barriers to practice sustainable facilities management (SFM).

A critical literature review was carried out into materials published in referred journals, conference papers and books etc. The findings revealed that, FM scope could be expanded among 15 support services among which building services and management, and real estate management were most commonly cited. In addition, SFM practices were identified in terms of achieving economic, environment and social sustainability. Accordingly, economic sustainability contains 2 strategies and 8 practices whileenvironment sustainability and social sustainability consist of 3 strategies and 11 practices, and 4 strategies and 15 practices respectively. The review further indicated that 32 barriers existing to practice SFM. This showcase that FM professionals need to focus on identifying firm specific FM scope and its sustainable practices by improving their capabilities.

Keywords: *Barriers; Facilities Management (FM); Sustainable Facilities Management (SFM); Support Services.*

1. INTRODUCTION

Buildings are the manifestation for all type of business activities and therefore incorporating sustainable practices in buildings is inevitable. In UK, the built environment is responsible for half of the carbon emissions, one-third of landfills, half of water consumption and one-quarter of all raw materials (Price et al. 2011). This places a high threat among building practitioners and government to make necessary arrangements to adapt sustainable practices. Integration of sustainability in built environment brings many benefits such as; improved productivity, greater financial returns, reduced detrimental effects on the environment and increased reputation (Shah, 2007). Herein, implementing sustainability is now a major obligation and expectation across many businesses and Facilities Management (FM) is identified at the forefront in delivering sustainability in organisation (Chotipanich, 2004). Further, FM is recognised as a "significant contributor or a key actor" in achieving sustainability in the context of built environment (Aune and Bye, 2005). Yet, different definitions and interpretation given for FM prevent creating a common platform to build a theoretical background on definition, scope and practice of FM to practice sustainability in organisations. Therefore, this paper intends to identify FM scope, its practices and thereby provides stratergies to make those practices sustainable subjected to existing barriers.

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To serve this purpose, the paper is organised as follows; firstly it presents the current FM scope and its practices. Secondly, Sustainable Facilities Management (SFM) was reviewed and SFM practices were identified. Finally, barriers which prevent integrating sustainability in to current FM practices were identified.

2. FACILITIES MANAGEMENT PRACTICES

Facilities Management (FM) is one of the emerging disciplines in the millennium era (Barrett and Baldry, 2003; Lomas, 1999). It is recognised and acknowledged by various organisations for managing and facilitating the built environment effectively (Chotipanich and Lertariyanun, 2011). Accordingly, FM is seen as a multi-disciplinary profession which covers a variety of activities, actions, roles, responsibilities and knowledge (Jones, 2000). However, the nature of FM is rapidly evolving and somewhat fluid (Durodola, 2009). This is evidenced through the contrasting definitions provided for the profession by different researches over the decade. For instance, the evolution of FM can be recognised through US Library of Congress (1989) definition, in which physical management of the built facility is stated as the function of FM. Whereas recent definitions provided by the professional institutes namely International Facility Management Association (IFMA, 2016) and British Institute of Facilities Management (BIFM, 2016) highlight FM as a multi-disciplinary discipline, which integrates people, process, place and technology to ensure the functionality of the built environment. This shows the shift of FM practices from being narrowly defined set of functional tasks to an integrated management approach to achieve corporate goals (Jones, 2000).

The definitions also contradict in identifying the managerial level of FM to distribute the works. For example, Nourse (1990) states that FM professionals function at the operational level and not aware of strategic function in organisations, whilst Becker (1990) highlights only the managerial function. This showcases the different perceptions of researchers. However, the evolution of FM is recognised in the later definitions provided by Nutt (1999) in which the author stressed that FM professionals are to function at all three (03) managerial levels i.e. top management, middle management and operational management. This means that FM is not merely functional at the operational level as it has been construed earlier rather it is more focussed on strategic decision making process to add value to the core objectives of an organisation (Alexander, 2003).

Further, definition for FM is very vague in establishing appropriate scope for FM in organisation because Barrett and Baldry (2003) and IFMA (2016) define FM as a multi-dimensional profession dealing with multiple support services. Here, FM scope is regarded as the various support services performed in the organisation. Initially, as of Becker (1990) FM profession was meant to operate hardware services of organisation i.e. buildings and their systems, equipment and furniture. But later FM profession was emphasised upon dealing with software services such as; people, place, process, space and technology etc. (Alexander, 1996; Nutt, 1999; BIFM, 2016; IFMA, 2016). This clearly demonstrates that FM scope is no more limited to physical aspects of buildings rather it is evolving and intends to embrace the practice of intangible resources of organisation i.e. involvement of FM practice in human resources, marketing management, information technology and workplace management etc. However, it is stated that FM professionals fail to determine the scope of FM, where real values can be added to the organisation through adaptation of appropriate support services (Boateng, 2011). This is due to the reason that FM have numerous definitions and interpreted differently in organisations, regions and countries, which caused confusion in the selection of FM scope for an organisation.

Furthermore, Owen (as cited in Durodola, 2009) affirm that FM profession can be better understood by exploring the scope and practice of FM and cannot be adequately ring-fenced by one definition or common statement (Durodola, 2009). Because, FM theory, practice and scope are broad in nature and continuously broadening due to more practitioners join the league of FM (Boateng, 2011). Hence, Table 1 presents the possible support services which could be performed in an organisation and thereby to define the scope of FM in an organisation.

Table 1: Support Services of FM

	Support services of FM	Sources										Frequency	Percentage
S1	Building services and management	1	2	3	4	5	6	7	8	9	10	~~IIII IIII~~	100%
S2	Real estate management	1	2	3	4	5	6		8	9	10	~~IIII~~ IIII	90%
S4	Property/Project management	1		3	4		6	7		9	10	~~IIII~~ II	70%

S3	Information technology		3		5	6	8	9	10	IIII I	60%
S5	Human resources management		3		5	6	8	9		IIII	50%
S6	Risk management	2	3	4		6	8			IIII	50%
S7	Quality management	2	3			6		9		IIII	40%
S8	Space planning and management	2		4			8		10	IIII	40%
S9	Office management	1		4			8		10	IIII	40%
S10	Operations administration/ Management			4	5	7				III	30%
S11	Planning and programming		3	4		7				III	30%
S12	Employee support services		3	4					10	III	30%
S13	Marketing management				5		8			II	20%
S14	Law			4		7				II	20%
S15	Finance management			4				9		II	20%

Sources;
[1] Thomson (1991)
[2] Kincaid (1994)
[3] Then (1999)
[4] Chotipanich (2004)
[5] Owen (as cited in Boateng, 2011)
[6] Boateng (2011)
[7] Then and McEwan (2004)
[8] Zheng (2012)
[9] Manjula *et al*. (2015)
[10] Isa *et al*. (2016)

In Table 1, building services and management is highlighted by all researchers with 100% agreement, whilst real estate management and property management are highlighted by 90% and 70% of the sample. This evidences the previous findings on FM being considered as an old fashioned profession, which operates in hardware services i.e. in the field of repairs, and maintenance in organisations. However, the evolution of FM scope can be predicted with the expansion of support services. This can be evidenced through information technology to finance management support services with receiving a sample in percentages varying from 60% to 20%. For example, Thomson (1991) specify some basic services to support the core objective of the organisations such as; building services and management, real estate management and property management etc. Later years, the FM scope evolved embracing many support services for the purpose of achieving the core objectives of the organisation such as; finance management, law, employment support services and space planning and management etc. This shows that FM scope in organisation are not limited rather very broad in nature and expands with innovation and integration of new technology.

Moreover, FM scope and its practices are not adapted as same for all organisation rather it is organization specific and differs in terms of facility features, organisational scale, business sector, organisation characteristics, culture and context where it is operated (Chotipanich, 2004). Hence, selection of appropriate FM scope and practices are very important and a hectic challenge borne by FM professional inside an organisation. Accordingly, 15 support services are identified in Table 1 and each of these support services may compromise of several FM practices. Moreover, a few FM practices may belong to several support services i.e. the practice of conducting marketing programmes and providing special promotions and campaigns may belong to real estate management or marketing management support services depending upon the business or industry the FM involve in. Thus, Figure 1 presents the possible FM practices that FM professionals can perform in each of the support services identified in Table 1.

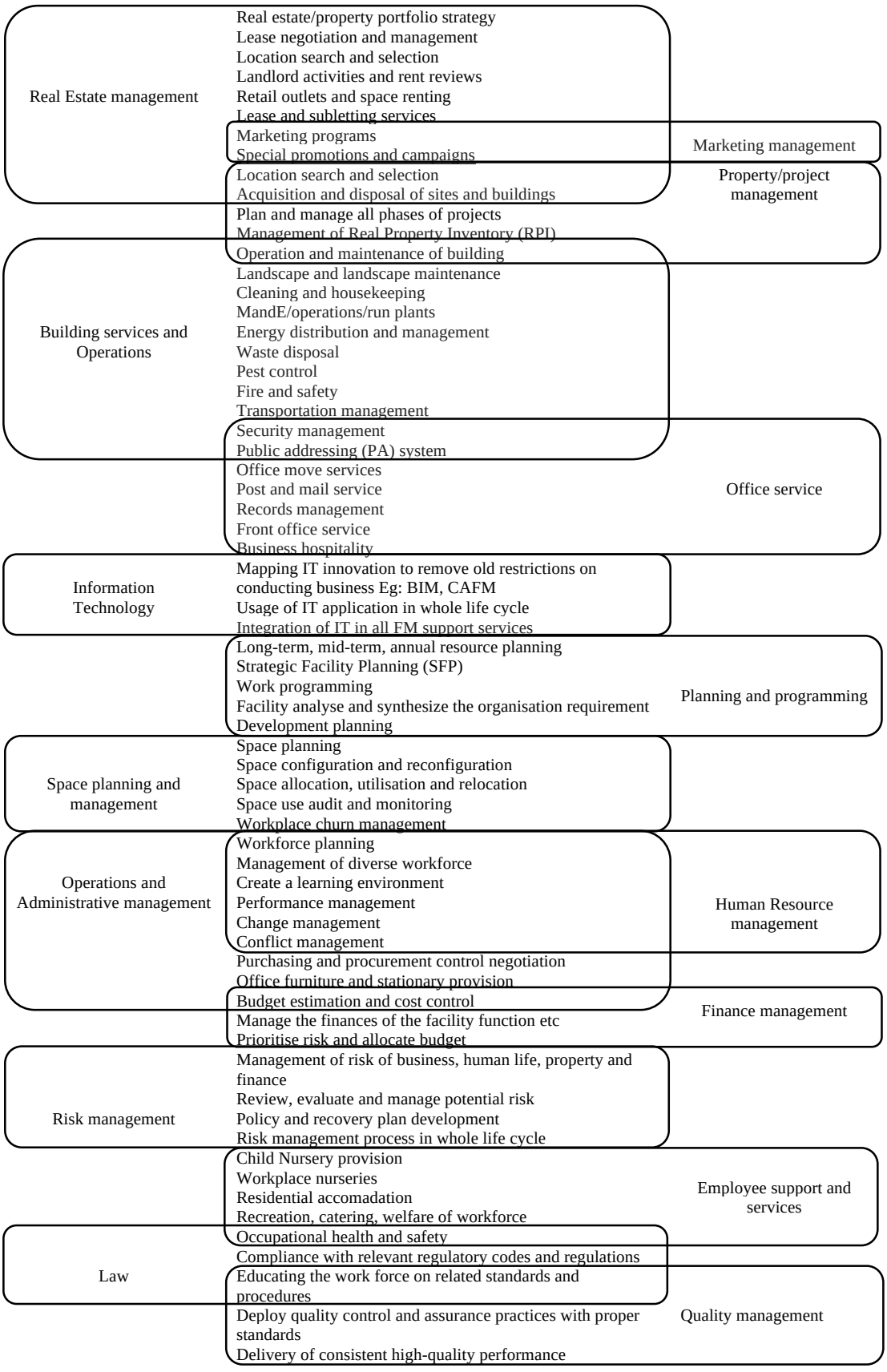

Figure 1: FM Support Services and Practices
(Source; Chotipanich, 2004)

3. SUSTAINABLE FACILITIES MANAGEMENT (SFM)

Sustainability concept came in to existence formally, consequent to the publication of Brundtland Commission Report 1980, in which sustainability is defined as "development that meets the needs of the present generation without compromising future generations to meet their own needs" (WCED, 1987). This awareness created a growing concern on many building operators and owners to showcase interest in integrating sustainable practices into buildings (Nielsen, Jensen and Jensen, 2009) due to the numerous benefits such as; cost reduction, improved productivity, improved quality of life and reduced impact on environment (Zuo and Zhao, 2014). Henceforth, sustainability is now a major obligation and expectation across many businesses (Stern, 2007). Consequently, buildings being the manifestation for all type of business activities, implementation of sustainable practices in buildings is inevitable (Elmualim *et al.*, 2010). Moreover, a holistic approach is needed in addressing sustainability covering all aspects i.e. economic, environment and social elements which is known as "triple bottom line concept" in implementing sustainability in buildings (Elmualim *et. al.*, 2009). Hence, practicing sustainability in a holistic manner addressing all three (03) elements are very important for any building practitioner. Herein, FM professionals are identified at the forefront in delivering sustainability, adapting organisational behavioural changes and who are in capacity to influence individual behavioural pattern of organisations to integrate sustainability (Meng, 2014).

Moreover, sustainability is influenced in building design and construction leading Sustainable Facilities Management (SFM) to be gradually recognized (Meng, 2014) and it is evolved in parallel with sustainable development and climate change concerns (Shah, 2007). In addition, the recognition of SFM among building practitioners is caused due to the challenges exist in built and natural environment today. For example challenges such as; carbon emission, landfills, water consumption and usage of raw materials etc. place a high threat among building practitioners and government to make necessity arrangements and urged for adaption of sustainable practices (Price *et al.* 2011). Accordingly, FM professionals too were, pressurised to practice sustainability to reduce the adverse effects caused (Meng, 2014).

Shah (2007) defined SFM as "delivery of sustainability within FM". In another definition provided by IFMA (2016) defined SFM as "integrating the people, place and business of an organisation that optimises economic, environmental, and social benefits of sustainability". Hence, both the definitions state moreover the same meaning that SFM means integrating sustainability in all FM practices.

Hence, this shift in FM is described as "sustainable movement" for FM today (Meng, 2014). This can be regarded as an opportunity to establish FM in the league in delivering sustainability, yet lack of specialist knowledge, capabilities, tools and case study materials are seen as major barriers (Loch, 2000). Adding to this Meng (2014) specify that the implementation of sustainable practice is not easy or straightforward. However, Bosch and Pearce (2003) argue that embracing sustainability in buildings are a realistic goal despite its complexity. Hence, to practice SFM, objectives, strategies and practices are needed. The Table 2, shows the possible SFM practices with appropriate strategies that could be integrated with current FM practices.

Table 2: SFM Objectives, Strategies and Practices

SFM objectives	Strategies	SFM practices	Sources
Achieving Environment Sustainability	Taking account of natural capacity	Assess and mitigate wider environmental impacts (e.g. water supply, sewerage, transport, waste, etc)	Shah, 2007
		Respond to projected impacts of climate change	
	Optimising environmental benefits	Minimise energy demand and achieve carbon neutrality	Akadiri *et al*.,2012; TEFMA, 2004; Shah, 2007
		Optimise efficiency of materials use	
		Maintain and enhance biodiversity	
		Aim to conserve resources such as; water, land, energy and material	
	Minimising negative impacts	Reduce, reuse, recycle, recover waste	
		Reduce emissions to air, land and water	
		Reduce transport impacts	Shah, 2007
		Protect ecological resources	
		Protect archaeological and historically valuable resources	

Achieving Economic Sustainability	Ensure economic viability and improving processes	Use technologies and material consistent with sustainability principles	
		Keep up-to-date with advances in construction technologies	Shah, 2007; TEFMA, 2004
		Use cost and benefit on whole life value basis	
		Manage supply chain effectively	
		Keep up-to-date with regularity and planning requirements	
		Maximise range of economic benefits including flexibility of use	Shah, 2007
	Enhancing business opportunities	Meet national, regional and local economic strategy	
		Capitalise funding for more sustainable development	TEFMA, 2004
Achieving Social Sustainability	Optimising opportunities and social benefits	Create usable public and private space to deliver successful communities (better workplace)	Shah, 2007 TEFMA, 2004
		Improve health wellbeing, accessibility and security of community	Akadiri *et al*.,2012; Shah, 2007
		Enhance employment and skills development opportunities for the local community	TEFMA, 2004
	Community Involvement and Development	Promoting sustainable communities through planning and design	Shah, 2007; TEFMA, 2004
		Consider and include aspects in the project that will enhance community development.	TEFMA, 2004
	Engaging stakeholders	Consult with public authorities, general public and involve other stakeholders and respond accordingly	Shah, 2007; TEFMA, 2004
		Include stakeholders in every stage of the facilities management	
		Consult and manage expectations of stakeholders on changes to ongoing use and operation	
	Minimising negative impacts	Plan for effective public and private transport use	
		Control nuisance (noise, dust, light etc)	Shah, 2007
		Ensure secure side in construction	
		Ensure health and safety of workers and local community	Akadiri *et al*.,2012; Shah, 2007 TEFMA, 2004
		Protect, enhance and maintain appropriate social access to environmentally sensitive areas	Shah, 2007
		Assess and mitigate flood risk	
		Design for crime prevention	Akadiri *et al*.,2012

Sustainability can be met upon three (03) main aspects of sustainability known as “triple bottom line” concept i.e. environment, economic and social aspects. Hence, achieving sustainability in terms of these three (03) aspects are very essential. For that purpose, SFM strategies and practices are identified aiming to achieve these three (03) objectives as presented in Table 2. Environment sustainability incorporates three (03) strategies and eleven (11) FM practices, economic sustainability includes two (02) strategies and eight (08) practices, while social sustainability unites four (04) strategies and 15 practices, respectively. Hence, adhering to these practices and strategies of sustainability will lead FM professional to practice SFM effectively. However, it is emphasised that only few FM professionals are able to embrace the sustainability criteria into their operations (Lai and Yik, 2006). This is due to several barriers in practicing sustainability in organisation and these factors are discussed in the following section.

4. BARRIERS FOR SFM PRACTICES

Despite the importance of sustainability has gained in last few decades, still intergrating sustainability into FM practice is challenging. Table 3 lists the possible barriers exist in terms of practicing SFM.

Table 3: Barriers in Practicing SFM Practices

Code	Barriers	Sources	Frequency	Percentage
SB1	Lack of capability and knowledge	[1-20][22-27]	26	96%
SB2	High cost	[1][3-23][25][26]	24	89%
SB3	Lack of government initiatives or support	[4-7][9][11][12][15-17] [19] [23-27]	16	59%
SB4	Lack of interest or demand from clients	[3][4][6][8-11][16][17][19] [20][22][23] [25]	14	52%
SB5	Lack of Green building guides or codes or regulation	[3][6][13][14][16][17][22-25]	10	37%
SB6	Lack of Technology	[3-7][10][14][16][17] [20][22][24-26]	12	44%
SB7	Lack of communication and interest among stakeholders	[2-4][10][12-16][22][27]	11	41%
SB8	Risks and uncertainty	[11][13][14][16][22-26]	09	33%
SB9	Project complexity	[4][6][10][12][13][16][19][24] [26]	09	33%
SB10	Scarcity of resources	[2][5][6][10][13][23][25]	07	26%
SB11	Resistance to change	[4][12][13][15][16][24]	06	22%
SB12	Duration of project	[4][12-14][19][22][26]	07	26%
SB13	Lack of authority and support in forcing green building laws	[3][9][14][22-24]	06	22%
SB14	Lack of promotion	[7][11][16][18][25][26]	06	22%
SB15	Lack of training	[14][16][17][19][24]	05	19%
SB16	Distrust of green building products	[2][6][12][24]	04	15%
SB17	Lack of finance	[6][9][11][20]	04	15%
SB18	Culture, attitude, norms and behaviour of people	[2][7][9][15]	04	15%
SB19	Rigid requirement	[12][13][23][26]	04	15%
SB20	Lack of certificate	[11][14][15][23]	04	15%
SB21	Inadequate building laws	[2][10][11][27]	04	15%
SB22	Political governmental issues	[6][9][11]	03	11%
SB23	High market values	[17][23][25]	03	11%
SB24	Improper property valuation system	[18][23][26]	03	11%
SB25	Long payback period	[20][26]	02	07%
SB26	Project location	[3][6]	02	07%
SB27	Poor quality of green building design	[1]	01	04%
SB28	Company size	[17][19]	02	07%
SB29	Lack of green building material suppliers	[20][23]	02	07%
SB30	Insurance liability issues	[20][23]	02	07%
SB31	Lack of tested, reliable green building materials locally	[10][12]	02	07%
SB32	Bureaucracy	[13]	01	04%

Sources;

[1] Bond (2011)
[2] Winston (2010)
[3] Williams and Dair (2007)
[4] Hwang and Tan (2010)
[5] Ghaffarian Hoseini *et al*. (2013)
[6] Luthra *et al*. (2015)
[7] Zhang *et al*. (2012)
[8] Zhao *et al*. (2015)
[9] Zhang and Wang (2013)
[10] Du *et al*. (2014)
[15] Kasai and Jabbour (2014)
[16] Djokoto *et al*.(2014)
[17] Zainul Abidin *et al*.(2013)
[18] Nahmens and Reichel (2013)
[19] Opoku and Ahmed (2014)
[20] Gou *et al*.(2013)
[21] Qian *et al*.(2015)
[22] Zhang *et al*. (2011)
[23] Häkkinen and Belloni (2011)
[24] Petri *et al*. (2014)

[11] Persson and Grönkvist (2015)	[24] Samari *et al*. (2013)
[12] Lam *et al*. (2009)	[26] Shi *et al*. (2013)
[13] Hwang and Ng (2013)	[27] Love *et al*. (2012)
[14] Zhang *et al*.(2011)	

Accordingly, Table 3 presents 32 barriers in terms of practicing SFM. Among these barriers, lack of capability and knowledge is identified as the major barrier with 96% percentage of agreement of the sample, while high cost was identified as the second important barrier with 89% agreement. Moreover, 14 barriers were classified as important through achieving more than 20% agreement from the sample while the rest of the 18 barriers achieved less than 20% of agreement, considered least important barriers. . Ultimately, being, lack of capability and skills were identified to be the most important barrier in practicing SFM, the finding showcases the need of researching capabilities of FM professionals to practice sustainability.

5. CONCLUSIONS

This paper critically reviewed the FM scopes in order to practice sustainability in various support services. Yet, FM support services and its practices are identified to be organisation specific providing tailored service. Herein, this study identifies fifteen (15) support services and relevant FM practices. Moreover, to integrate sustainability this study adapts the triple bottom line concept of sustainability and establishes suitable strategies, objectives and practices to the current FM practice. For example, environment sustainability incorporates three (03) strategies and eleven (11) FM practices, economic sustainability includes two (02) strategies and eight (08) practices, while social sustainability unites four (04) strategies and (15) practices. However, SFM practices are challenging and 32 barriers were identified which prevents practicing sustainability. Here, lack of capability and knowledge being highlighted by 96% of researchers whilst high cost was agreed by 89% of researchers. Hence, the findings reveals that the researcher should focus on identifying SFM practices in depth in terms of each specific support services and to examine the barrier "lack of capability" which prevents practicing SFM.

6. REFERENCES

Akadiri, P. O., Chinyio, E. A., and Olomolaiye, P. O. (2012). Design of a sustainable building: A conceptual framework for implementing sustainability in the building sector. *Buildings*, 2(2), 126-152.

Alexander, K. (1996). A Strategy for Facilities Management. *Facilities*, 12(11), 6-10.

Alexander, K. (2003). A strategy for facilities management. *Facilities*, 21(11/12), 269-274.

Aune, M. and Bye, R., 2005. Buildings that learn – the role of building operators. In: *European Council for an Energy Efficient Economy (ECEEE) summer study; What works and who delivers*?. Sweden. 415-422.

Barrett, P. and Baldry, D. (2003). *Facilities management*. Osney Mead, Oxford, OX: Blackwell Science.

Becker, F. (1990). *The total workplace*. New York: Van Nostrand Reinhold.

BIFM, (2016). BIFM - *Facilities Management Introduction.* [online] Bifm.org.uk. Available from: http://www.bifm.org.uk/bifm/about/facilities [Accessed 26 Sep. 2016].

Boateng, E., 2011. *The future of facility management in Finland*. (B.Sc). School of Business and Services Management, Jamk University of Applied Sciences.

Bond, S. (2011). Barriers and drivers to green buildings in Australia and New Zealand. *Journal of Property Investment and Finance*, 29(4/5), 494-509.

Bosch, S.J. and Pearce, A.R., 2003. Sustainability in public facilities: Analysis of guidance documents. *Journal of Performance of Constructed Facilities*, 17(1), 9-18.

Chotipanich, S. and Lertariyanun, V., 2011. A study of facility management strategy: the case of commercial banks in Thailand. *Journal of Facilities Management*, 9(4), 282-299.

Chotipanich, S., 2004. Positioning facility management. *Facilities*, 22(13/14), 364-372.

Djokoto, S.D., Dadzie, J. and Ohemeng-Ababio, E., 2014. Barriers to sustainable construction in the Ghanaian construction industry: consultants perspectives. *Journal of Sustainable Development*, 7(1), 134.

Du, P., Zheng, L.Q., Xie, B.C. and Mahalingam, A., 2014. Barriers to the adoption of energy-saving technologies in the building sector: A survey study of Jing-jin-tang, China. *Energy Policy*, 75, 206-216.

Durodola, O.D., 2009. Management of hotel properties in south-western Nigeria: facilities management perspective Doctoral dissertation, Covenant University.

Elmualim, A., Czwakiel, A., Valle, R., Ludlow, G. and Shah, S. 2009. The Practice of Sustainable Facilities Management: Design Sentiments and the Knowledge Chasm. *Architectural Engineering and Design Management*, 5(1), 91-102.

Elmualim, A., Shockley, D., Valle, R., Ludlow, G. and Shah, S., 2010. Barriers and commitment of facilities management profession to the sustainability agenda. *Building and Environment*, 45(1), 58-64.

GhaffarianHoseini, A., Dahlan, N., Berardi, U., GhaffarianHoseini, A., Makaremi, N. and GhaffarianHoseini, M. (2013). Sustainable energy performances of green buildings: A review of current theories, implementations and challenges. *Renewable and Sustainable Energy Reviews*, 25, 1-17

Gou, Z., Lau, S. and Prasad, D. (2013). Market Readiness And Policy Implications For Green Buildings: Case Study From Hong Kong. *Journal of Green Building*, 8(2), 162-173.

Häkkinen, T. and Belloni, K. (2011). Barriers and drivers for sustainable building. *Building Research and Information*, 39(3), 239-255

Hwang, B. and Ng, W. (2013). Project management knowledge and skills for green construction: overcoming challenges. IEEE Engineering Management Review, 41(2), 87-103.

Hwang, B. and Tan, J. (2010). Green building project management: obstacles and solutions for sustainable development. *Sustainable Development*, 20(5), 335-349

IFMA (2017). *What is FM - Definition of Facility Management.* [online] Ifma.org. Available from: https://www.ifma.org/about/what-is-facility-management [Accessed 13 Jun. 2017].

Isa, N.M., Kamaruzzaman, S.N., Mohamed, O., Jaapar, A. and Asbollah, A.Z., 2016. Facilities Management Practices in Malaysia: A Literature Review. In *4th International Building Control Conference 2016 (IBCC 2016)*,(Vol. 66, p. 00054). 07 Mar 2016 - 08 Mar 2016. Pullman Bangsar Hotel, Kuala Lumpur.

Jones, O., 2000. Facility management: future opportunities, scope and impact. *Facilities*, 18(3/4), 133-137.

Kasai, N. and Jabbour, C. 2014. Barriers to green buildings at two Brazilian Engineering Schools. International *Journal of Sustainable Built Environment*, 3(1), 87-95.

Kincaid, D., 1994. Integrated facility management. *Facilities*, 12(8), 20-23.

Lai, J.H. and Yik, F.W., 2006. Knowledge and perception of operation and maintenance practitioners in Hong Kong about sustainable buildings. *Facilities*, 24(3/4), 90-105.

Lam, P., Chan, E., Chau, C., Poon, C. and Chun, K. 2009. Integrating Green Specifications in Construction and Overcoming Barriers in Their Use. *Journal of Professional Issues in Engineering Education and Practice*, 135(4), 142-152.

Loch, B., 2000. Avoiding the usual suspects. *Facilities*, 18(10/11/12), 368-370.

Lomas, D.W., 1999. Facilities management development in Hong Kong. *Facilities*, 17(12/13), 470-475.

Love, P., Niedzweicki, M., Bullen, P. and Edwards, D. 2012. Achieving the Green Building Council of Australia's World Leadership Rating in an Office Building in Perth. *Journal of Construction Engineering and Managemen*t, 138(5), 652-660

Luthra, S., Kumar, S., Garg, D. and Haleem, A., 2015. Barriers to renewable/sustainable energy technologies adoption: Indian perspective. *Renewable and sustainable energy Reviews*, 41, 762-776.

Manjula, N.H.C., Dissanayake, D.M.P.P. and Rajini, P.A.D., 2016. Facilities Management Approaches for Sustainability. In *6th International Conference on Structural Engineering and Construction Management*, 11th - 14th December 2016, Kandy, Sri Lanka

Meng, X. 2014. The role of facilities managers in sustainable practice in the UK and Ireland. *Smart and Sustainable Built Environment*, 3(1), 23-34.

Nahmens, I. and Reichel, C. 2013. Adoption of high performance building systems in hot- humid climates – lessons learned. *Construction Innovation*, 13(2), 186-201.

Nielsen, S.B., Jensen, J.O. and Jensen, P.A., 2009. Delivering sustainable facilities management in Danish housing estates. In 2nd *International Conference on Sustainability Measurement and Modelling ICSMM 09© CIMNE*, Barcelona. pp. 135.Nourse, H. 1990. Managerial real estate. Englewood Cliffs, N.J.: Prentice-Hall.

Nutt, B., 1999. Linking FM practice and research. *Facilities*, 17(1/2), 11-17.

Opoku, A. and Ahmed, V. 2014. Embracing sustainability practices in UK construction organizations. *Built Environment Project and Asset Management*, 4(1), 90-107.

Persson, J., and Grönkvist, S. 2015. Drivers for and barriers to low-energy buildings in Sweden. *Journal of Cleaner Production*, 109, 296-304.

Petri, I., Rezgui, Y., Beach, T., Li, H., Arnesano, M. and Revel, G. 2014. A semantic service oriented platform for energy efficient buildings. *Clean Technologies and Environmental Policy*, 17(3), 721-734

Price, S., Pitt, M. and Tucker, M., 2011. Implications of a sustainability policy for facilities management organisations. *Facilities*, 29(9/10), 391-410.

Qian, Q., Chan, E. and Khalid, A. 2015. Challenges in Delivering Green Building Projects: Unearthing the Transaction Costs (TCs). *Sustainability*, 7(4), 3615-3636

Samari, M., Ghodrati, N., Esmaeilifar, R., Olfat, P. and Mohd Shafiei, M. 2013. The Investigation of the Barriers in Developing Green Building in Malaysia. *Modern Applied Science*, 7(2). 1-10.

Shah, S. 2008. *Sustainable Practice for the Facilities Manager*. 1st ed. New York, NY: John Wiley and Sons.

Shi, Q., Zuo, J., Huang, R., Huang, J. and Pullen, S. 2013. Identifying the critical factors for green construction – An empirical study in China. *Habitat International*, 40, 1-8

Shiem-Shin Then, D., 1999. An integrated resource management view of facilities management. *Facilities*, 17(12/13), 462-469.

Stern, N.H., 2007. *The economics of climate change: the Stern review*. Cambridge University press.

Tertiary Education Facilities Management Association (TEFMA), 2004. A Guide to Incorporating Sustainability into Facilities Management. Austrailia. Available from: https://www.ifma.org/about/what-is-facility-management [Accessed 13 Jun. 2017].

Then, S.S.D. and McEwan, A., 2004. Capturing knowledge from facilities management practice-issues and possibilities. In: *Hong Kong 2004 CIBW70 International Symposium*, Hong Kong. pp. 251-263Thomson, T., 1991. Matching services to business needs: resourcing routine services and projects. *Facilities*, 9(6), 7-13.

US Library of Congress, 1989. In Mole, T. and Taylor, F. 1992. Facility Management: Evolution or Revolution. In Barrett, P. (Ed.), 1993. *Facilities Management – Research Directions*, London: Surveyors Holdings Limited.

WCED. 1987. *Our Common Future*. World Commission on Environment and Development. Oxford University Press. Oxford, New York.

Williams, K. and Dair, C. 2007. What is stopping sustainable building in England? Barriers experienced by stakeholders in delivering sustainable developments. *Sustainable Development*, 15(3), 135-147.

Winston, N. (2010). Regeneration for sustainable communities? Barriers to implementing sustainable housing in urban areas. *Sustainable Development*, 18(6), 319-330.

Zainul Abidin, N., Yusof, N. and Othman, A. 2013. Enablers and challenges of a sustainable housing industry in Malaysia. *Construction Innovation*, 13(1), 10-25.

Zhang, X., Platten, A. and Shen, L. 2011. Green property development practice in China: Costs and barriers. *Building and Environment*, 46(11), 2153-2160.

Zhang, X., Shen, L., Tam, V. and Lee, W. 2012. Barriers to implement extensive green roof systems: A Hong Kong study. *Renewable and Sustainable Energy Reviews*, 16(1), 314-319.

Zhang, Y. and Wang, Y., 2013. Barriers' and policies' analysis of China's building energy efficiency. *Energy Policy*, 62, 768-773.

Zhao, D.X., He, B.J., Johnson, C. and Mou, B., 2015. Social problems of green buildings: From the humanistic needs to social acceptance. *Renewable and Sustainable Energy Reviews*, 51, 1594-1609.

Zheng, L., 2012. Developing the understanding of facility management demand by small and medium enterprises in the UK and China. MSc. The Bartlett School of Graduate Studies - UCL

Zuo, J. and Zhao, Z.Y., 2014. Green building research–current status and future agenda: A review. Renewable and *Sustainable Energy Reviews*, 30, 271-281.