Environmental Technology & Science Journal
Vol. 11 No. 1 June 2020

Assessing the Underlying Factors Influencing the Adoption of Technological Innovations in South African Facility Management

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Received: 17/4/2020 **Reviewed: 2/5/2020** **Accepted: 12/6/2020**

There is limited information on the factors influencing the adoption of technological innovation (TI) in emerging economies as compared to the developed economies. It therefore implies that most of the factors influencing TI adoption in literature lack empirical basis from the developing economies. Hence, this study examines the underlying factors influencing the adoption of technological innovations in South African facility management. The literature review revealed 26 factors that influence the adoption of TI in facility management (FM) organizations. These factors were thematically categorised into 6 constructs. A structured questionnaire was developed to assess these construct among 85 FM organizations registered with the South African Facilities Management Association. Non-parametric statistical tool was employed using the Relative importance index approach (RII) to examine the factors that affect the adoption of TI in South Africa as an emerging economy. The findings showed that the top three factors influencing the adoption of TI in South Africa FM organizations are: improved decision-making, apparent usefulness of technology, and increased job efficiency, while the top three constructs that influence the adoption of TI in South Africa FM organizations are: effort expectancy, social influence, and performance expectancy respectively. The finding of this study shows that "effort expectancy" and "social influence" are stronger construct in developing economy such as South Africa as against "performance expectancy" construct that appeared prominent in developed economies. It is recommended that country specific factors should be considered when adopting technology in different climes.

Keywords: facilities management, relative importance index, technology adoption, technological innovations, South Africa

Introduction

In the wake of the industrial revolution, it became obvious that organizations needed to concentrate on the core objectives of their operations while other professionals help to take responsibility for the non-core objectives. Facility management (FM), being a profession that co-ordinates and manages an extensive range of specialist activities including properties and estates, construction and refurbishments, workspace, maintenance and operations, information technology (IT), support services, and human resources readily qualified as one of the professions that take responsibility for the non-core operations of organizations. FM also helps to undertake quality-assessments of labour practices, environments and activities relating to the wellbeing of employees (Goyal & Pitt, 2007). All these activities of FM are central to the success of any organisation.

However, as the nature of business experienced innovative and technological changes, FM needed to adopt technologies

for enhanced support service operations (Teicholz, 2001). With particular reference to the growth of information technology (IT) and its potential to lower the cost of doing business, facilities managers embraced IT automation to further enhance efficient service delivery. Several authors have identified other factors that influence the adoption of technology in FM organizations. For instance, Lunn and Stephenson (2000) in a study carried out in the United Kingdom argued that ten factors can potentially affect TI adoption in FM based on demand impact. Chwelos *et al.* (2001) in another study argued that top management support, perceived benefits, IT sophistication, and external forces influence the adoption of technology in organisation. Furthermore, Venkatesh *et al.* (2003) in a study that aimed towards finding a unified model of TI in the USA developed the Unified Theory of Acceptance and Use of Technology (UTAUT) model to investigate factors that influence technology adoption. Liu *et al.* (2010) in a study that researched the driving factors of mobile learning in China argued that management support, perceived benefits, internal readiness, and external forces influence the adoption of TI in organizations. Talukder (2012) affirmed that perceived usefulness and managerial support are more dominant factors that influenced the adoption of TI by individual employees in Australia.

It is obvious from the many studies that one cannot generalise the findings of factors that influence the adoption of TI because different factors are responsible for the adoption of TI in different regions. Gururajan *et al.* (2004) argued that different factors could influence TI adoption in emerging economies as against what is obtainable in developed economies. For instance, the FM industry in South Africa is more operational in nature and relies on manual labour in its operations; hence, it is still emerging with regard to technology adoption. Therefore, identifying the factors that influence the adoption of TIs in South Africa will help FM organizations maximise the opportunities of TI adoption. It is against this background that this study contributes to the literature on the factors influencing the adoption of TIs in FM organizations in South Africa as an emerging economy.

Literature Review

Impact of TI on FM Practice

Technology is crucial to FM profession given that the advancement in technology was among the various factors that led to the development of FM profession (Alexander, 1994; Price, 2003; Moore & Finch, 2004). According to Alexander (1994) and Price (2003), the growth of technology in the business sector in the 1970s made organizations to concentrate more on their core business while other professionals took care of the non-core business concerns. The adoption of TI in FM organizations provides opportunities to optimise employee capabilities, respond to customer needs, gain valuable feedback, and useful information for the enhancement of FM operations (Lindkvist & Elmualim, 2009; Martin & Omrani, 2015; Kandampully *et al.*, 2016). Previous studies have argued that the adoption of TI holds enormous potential for the achievement of core FM business goals which include productivity, running cost, efficiency, corporate image, flexibility, and connectivity (Grimshaw, 2007; Barret & Baldry, 2009).

Factors Influencing the Adoption of TIs in FM Organizations

Extant studies have argued differently on the factors that influence the adoption of TI in FM organizations. For example, Lunn and Stephenson (2000) argue that the adoption of TI in FM is influenced by either a demand impact on the organisation or a system impact. The demand impact refers to the pressure that the business' competition puts on the organisation to adopt TI in its operations. Based on the demand impact, Lunn and Stephenson (2000) and Cesar-Gabriel (2003), in previous studies, highlight ten factors that can influence the adoption of TI in FM organizations. The factors include information technology, global competition, cost of facilities, churn rate (the rate at which customers stop subscribing to a service or employees leave

a job), employee expectations, information demands, cost of mistakes, design and the need for inventory, strategic resource management, and change mechanisms.

Chwelos *et al.* (2001) ranks the factors that influence the adoption of TI in organizations (FM inclusive) in order of priority as: top management support, perceived benefits, IT sophistication, and external forces. In another study, Liu *et al.* (2010) argue that management support, perceived benefits, internal readiness, and external forces are the factors that influence the adoption of TIs. Talukder (2012) argues that perceived usefulness and managerial support are more dominant factors compared to others such as peers, social networks, and demographic factors, in adopting TI in any organisation. Furthermore, UTAUT model was developed by Venkatesh *et al.* (2003) in the USA to investigate factors that influence technology adoption. The UTAUT classified the factors that influence the adoption of TI in FM organizations into constructs such as performance expectancy, effort expectancy, social influence, facilitating conditions, top management support, and individual resistance to change.

Venkatesh *et al.* (2003) define performance expectancy as the degree to which an organisation trusts a form of technology to accomplish better job performance. The study further highlighted the factors under the performance expectancy construct to include perceived usefulness, extrinsic motivation, job fit, relative advantage, and outcome expectations. Several previous studies acknowledge the consistency and strong predictive characteristics of performance expectancy construct in adoption of technology in organizations (Thompson *et al.*, 1991; Davis *et al.*, 1992; Compeau & Higgins 1995; Taylor & Todd 1995; Agarwal & Prasad 1998; Venkatesh & Davis, 2000).

Effort expectancy is the measure of ease that is experienced with the use of a technology (Venkatesh *et al.*, 2003). Three factors that make up the effort expectancy are: ease of use; complexity; and perceived ease of use (Nassuora, 2012; Sargent *et al.*, 2012). Ease of use is the extent to which an individual believes that using technology would free them from physical and mental efforts (Davis *et al.*, 1989; Moore & Benbasat, 1991; Nassuora, 2012). Complexity refers to the extent to which technology is perceived as difficult to understand and use (Thompson & Higgins, 1991).

Social influence is driven by the expectations that other people or competitors have that an organisation should have adopted technology (Venkatesh *et al.*, 2003). Three factors define the social influence, namely: subjective norms; social factors; and image (Sargent *et al.*, 2012). Facilitating conditions are the extent to which infrastructure is available in the organisation and from a technical perspective it refers to the support structures for the use of an adopted technology (Venkatesh *et al.*, 2003). Three factors that measure facilitating conditions are namely: perceived behavioural control; facilitating conditions; and compatibility.

Peansupap and Walker (2005) affirmed that the implementation of a successful technology adoption will require support and encouragement from senior managers. Support and encouragement involve the managers devoting time to develop the use of the technology within the organisation through reviewing plans, monitoring results and facilitating the integration of the technology within the process of the business (Young & Jordan, 2008). Top management support inspires technology usage. The factors that indicate support from management include the aligning the TI implementation with the overall strategic objective of the organisation, provision of adequate training and the negotiation of adequate after sale service from vendors.

The individual resistance to change reflects the "individual's tendency to resist change and predict reactions to specify change" (Oreg, 2003:680). Bovey and Hede (2001) acknowledge that employees are naturally resistant to change in the organisation because change involves going from the

known to the unknown. Often times, the failure of technology in organizations reflect the inability to manage employee resistance to change (Venkatesh *et al.*, 2003; Sargent *et al.*, 2012). Hence, managers must consider the employees' disposition to change in the organisation (Sargent *et al.*, 2012). Due to the comprehensive nature of the UTUAT model, several studies in the construction management field have adopted the model in numerous studies (Hjelt & Björk, 2007; Adriaanse *et al.*, 2010; Samuelson, 2011). This study also adopted the UTUAT model in assessing the relative importance of the factors that influence the adoption of TI in FM organizations operating in South Africa.

Sieving through research efforts in technology adoption in different countries of the world; it was observed that studies from African countries are missing in the mix (see Table 1). This study will therefore serve as contribution to knowledge in the area of technology innovation application in Africa.

Research Methodology

The study identified through in-depth review of literature the factors that influence the adoption of technological innovations in organizations and these were thematically grouped under different constructs. The UTUAT model which is more comprehensive in the adoption of technology issues was adopted for the purpose of this study. Based on the factors in the UTUAT model, a questionnaire was constructed and distributed throughout FM organizations that were registered with South Africa Facilities Management Association (SAFMA). The research instrument has two important sections namely general information and the section that interrogated the factors influencing the adoption of TIs in South Africa. A total of Eighty-five (85) FM organizations registered with SAFMA was found on the website of the organisation as at May 2016. A country-wide survey was conducted using the SurveyMonkey (www.surveymonkey.com). An internet-based link that was generated from the SurveyMonkey was sent to the registered FM organizations (Saunders *et al.*, 2009). Out of 85 questionnaires that were administered through the web-based link, 22 respondents representing 26% were returned and considerably completed. Knowing that the response rate of online survey is 20% to 30% (Al-Tmeemy *et al.*, 2011; Oyewobi, 2014), the 26% response rate was considered suitable for the analysis.

Table 1: Factors/constructs that influence TI adoption as found in extant studies

Author	Country	Factors influencing technology adoption
Lunn and Stephenson (2000)	United Kingdom	Information technology, global competition, cost of facilities, churn rate, employee expectations, information demands, cost of mistakes, design and the need for inventory, strategic resource management, and change mechanisms.
Chwelos *et al.* (2001)	Canada	Top management support, perceived benefits, IT sophistication, and external forces.
Liu *et al.* (2010).	China	Management support, perceived benefits, internal readiness, and external forces are the factors that influence the adoption of TIs
Talukder (2012)	Australia	perceived usefulness and managerial support are more dominant factors that influenced the adoption of TI by individual employees
Venkatesh *et al.* (2003)	USA	Performance expectancy, effort expectancy, social influence, facilitating conditions, top management support, and individual resistance to change.

The factors influencing the adoption of TIs in FM organizations were measured on a five-point Likert scale in the questionnaire with the lowest value 1= very low, 2 = low, 3 = medium, 4 = high and 5 = very high. Relative importance index (RII) was used to analyse the data. RII helps to find the contribution of a particular factor to the influence of overall factors on the adoption of technological innovations in South Africa FM organizations (Johnson and LeBreton, 2004). According to Badu *et al.* (2013), the formula for RII is:

$$RII = \sum w / A * N$$

Where w = weights given to each factor by the respondents, which ranges from 1 to 5 where 1 is "very low" and 5 is "very high". A – the highest response integer (5); and N – the total number of respondents.

Results

Respondent demographic characteristics

The data presented in Table 2 showed that 77.3% of the organisations that took part in the research had been in FM business for over ten years, while 22.7% had ten years' and less experience. The result implied that majority of respondents' organisations had considerable experience in the South African FM industry. This was important for the study because it substantiated the reliability of data and the subsequent findings. Table 2 also showed that 72.7% of the organisations that took part in the study had more than 50 employees. The result implied that the organisations are large, and therefore, will support the generalisation of findings. With regards to academic qualifications, only 26.3% of the respondents had bachelor degree and above while 73.7% had less than bachelor's degree. The result may be partly responsible for the high level of operational FM practice in South Africa.

Table 2: Respondents demography

Years in Business	Frequency	Valid percent	Cumulative percentage
1-5yrs	4	18.2	18.2
6-10yrs	1	4.5	22.7
11-16yrs	2	9.1	31.8
16-20yrs	2	9.1	40.9
Above 20yrs	13	59.1	100
Number of Employees			
1-10	2	9.1	9.1
11-20	1	4.6	13.7
21-50	3	13.6	27.3
51-100	3	13.6	40.9
Above 100	13	59.1	100
Highest Academic Qualification			
Certificate	10	52.6	52.6
Diploma	4	21.1	73.7
Bachelor's degree	4	21.1	94.8
Master's degree	1	5.2	100
Doctorate			
Others			

Table 3: Factors Influencing the Adoption of TIs in FM Organizations

Factors influencing the adoption of TIs	Freq.	SD	∑w	RII	ØRII	R	OR
Performance expectancy							
Improves job performance	21	0.51	74	0.705		3	9
Increases job efficiency	20	0.66	74	0.740			3
Increases the pace of work delivery	21	0.86	71	0.676			13
Work volume is increased	21	0.72	69	0.657			15
Work quality is improved	21	0.60	73	0.695			11
Apparent usefulness of the technology	21	0.44	79	0.752			2
Relative advantage over competitors	21	1.06	70	0.667			14
Overhead cost is reduced	21	0.74	71	0.676			13
					0.696		
Facilitating conditions							
Simplification of work	21	0.48	77	0.733		6	5
Workers are easily trained to understand the job	21	0.70	68	0.648			16
Reduced complexity of FM operation	21	0.80	64	0.610			20
Compatible with current trends in FM operations	21	1.02	64	0.610			20
					0.650		
Effort expectancy							
Work is made easier	20	0.51	70	0.700		1	10
The technology is easy to use	21	0.68	74	0.705			9
The work is less challenging with technology	21	0.48	70	0.667			14
The human input in operation is reduced	21	0.81	73	0.695			4
Improved decision-making	21	0.62	82	0.781			1
					0.710		
Social influence							
Organisation image is enhanced	21	0.92	76	0.724		2	6
The comparative advantage is increased	21	0.75	75	0.714			8
The capability of the firm among competitors	21	1.12	74	0.705			9
Employee motivation and interpersonal relations	22	0.69	71	0.645			17
					0.697		
Employee resistance to change							
Employees are receptive to new changes	22	0.68	68	0.618		5	7
Supports employee continuous innovation	22	0.50	79	0.718			19
					0.668		
Top management support							
In line with overall objective of organisation	22	0.57	81	0.736		4	4
Intended adequate training and retraining	22	0.89	75	0.682			12
Adequate after sales support service from vendor	22	1.08	69	0.627			18
					0.682		

Freq.: frequency; SD: standard deviation; ∑w: weighted total; RII: relative importance index; ØRII: average relative importance index; R: rank; OR: overall rank

Discussion of Results

The 26 factors that were used in evaluating the adoption of TI in FM organizations were grouped into 6 constructs according the UTUAT model namely: performance expectancy, facilitating conditions, effort expectancy, social influence, employees' resistance to change, and top management support. The results showed that the "performance expectancy" construct with 8 factors, had the highest number of factors, while the "employee's resistance to change" construct consisted of only 2 factors. All the factors in the different constructs have RII >0.5. This result implies that respondents accorded significant importance to all the factors that influence the adoption of TIs in FM organizations. An evaluation of the RII according to these constructs shows that the "effort expectancy" construct have the highest RII value of 0.71. This value implies that the factors in the construct are more responsible for influencing the adoption of TI amongst the 6 constructs. The "social influence" construct with an average RII of 0.697 was the next. "Performance

expectancy" has an average RII of 0.696, "top management support" has an average RII of 0.682, and "employee resistance to change" has an average RII of 0.668 while "facilitating conditions" has an average RII of 0.65 influence on the adoption of TI in South African FM organizations. The result implies that the critical motivating factors that influence TI adoption in South African FM organizations are the ease and flexibility with which jobs are performed and decisions are supported in addition to the competitive advantage that the TIs bring to the organizations.

However, an evaluation of the RII of the individual factors in the different constructs showed that the "apparent usefulness of technology" under the "performance expectancy" construct has the highest RII of 0.752. Furthermore, this factor emerged as the overall 2nd factor amongst the 26 factors that influence the adoption of technology. "Apparent usefulness" is noted as a fundamental factor that determines adoption of TI in different adoption theories. The Technology Acceptance Model (TAM) notes that "apparent usefulness" is a fundamental factor in a technology adoption decision (Davis, 1989; Talukder, 2012). The result implies potential usefulness can influence the adoption of technology in an organisation.

"Increase job efficiency" factor with an RII of 0.74 ranked second. This factor also ranks as the 3rd overall to consider when adopting TI. The factor ensures that the adoption of TIs positively influences job efficiency. This result resonates with previous studies, which affirm that the adoption of technology provides the landscape for improved business efficiency by lowering costs and time-consuming processes as well as increasing revenues, effective operations, and creating a more attractive workplace (Logan, 2016). Logan further posits that the introduction and use of TIs help to streamline work processes and increase employee job efficiency. However, the factor of "relative advantage over competitors" was rated lowest with an RII of 0.667. The implication is that a TI which is not easy to use is likely to hinder the competitive edge of an organisation regardless of its perceived benefits (Lourens & Jonker, 2013).

In the "facilitating conditions" construct, "simplification of work" was rated highest with an RII of 0.733. It also ranked as the 5th overall among the technology adoption factors. The task of fully understanding the nuances of a TI and its potential is critical to job simplification (Swanson & Ramiller, 2004). In the same construct, "easy to train workers to understand the work" ranked second with an RII of 0.648. It, however, emerged as the 16th most important factor on the overall ranking. According to Zhao and Cziko (2001), training is a key factor that influences the adoption of TIs in organizations. From this result, it is obvious that when the work is simplified, it becomes much easier to train workers in the various aspects of the work.

In the construct of "effort expectancy", the factor of "improved decision-making" had the highest overall RII of 0.781. This factor also ranked as the first overall factor influencing the adoption of TI in FM organisation. It is predictable that management of any organisation will support TIs that can enhance decision-making through relevant information (Kokos, 2004). This result reflects Atkin and Bildsten's argument which suggested that sound decision-making is the foundation for organisation success. Management will, therefore, deploy resources that will aid the process of decision-making, including the adoption of TIs (Atkin & Bildsten, 2017).

The "technology is easy to use" is the next factor in the construct with an RII value of 0.705. According to Agarwal and Karahanna (2000), ease of use is an indication that technology will be relatively free of cognitive burden. From the above result, it can be deduced that the need to reduce the burden of work have a huge influence in technology adoption. Agarwal and Karahanna (2000) further argue that when employees perceive that technology

creates ample time for task completion, there is generally a higher acceptance of such technology. This result further agrees with the argument of other studies that sees perceived usefulness and perceived ease of use as crucial factors of technology acceptance (Davis, 1989; Tseng, 2011; Talukder, 2012).

Under the "social influence" construct, "organisation image is enhanced" was ranked 1st with an RII of 0.724. The image of the organisation is a key factor in sustainable operations (Rodrigues, & Franco, 2019). Therefore, organizations seek to deploy technology that will enhance their corporate image. This factor is important to technology adoption in FM organisation as respondents rank it 6th on the overall ranking. "Improved comparative advantage" was ranked next in this construct with an RII of 0.714 and ranked as the 8th most important factor on an overall scale.

In the "employee resistant to change" construct, "supports employee continuous innovation" ranked higher with an RII of 0.718 and also emerged as the 7th overall most important factor that influences the adoption of TIs in FM organizations. In the construct of "management support", the factor of "technology is in line with the overall policy of the organisation" was ranked highest and overall 4th most important factor with an RII of 0.736. The response is understandable since organizations will not sustain actions that are not supportive of their strategic goals (Pfeffer, 2009). The "assurance of training and retraining" ranked 2nd with an RII of 0.682 while "assurance of after sales support" was ranked the least with an RII of 0.627. The result implies that TI adoption must support the strategic objectives of organizations above any other considerations to qualify for adoption.

Conclusion

The study assessed the factors influencing the adoption of TI in South Africa using the RII method. It was found that all the listed factors influencing the adoption of TI in FM organizations in South Africa had RII > 0.5 indicating that the factors were all significant. However, the top three factors influencing the adoption of TI in South Africa FM organizations based on RII are: "improved decision-making", "apparent usefulness of technology", and "increased job efficiency", while the top three constructs that influence the adoption of TI in South Africa FM organizations are: "effort expectancy", "social influence", and "performance expectancy" respectively. The findings in this study are at variance with those of other studies in the literature where the "performance expectancy" construct emerged as the strongest factor influencing the adoption of TIs in organizations. The implications of the finding is a further support the assertion that the factors that influence TI adoption in developed economies may not necessarily be the same for emerging economies. Hence, location specific TI factors are critical points to consider when adopting TIs in different regions, especially in developing economies. The limitation of the study is the fact that the findings cannot be generalised because only one developing economy was used. It is recommended that further studies should consider using many developing economies.

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