Technology in Society 43 (2015) 209–218

Contents lists available at ScienceDirect

Technology in Society

journal homepage: www.elsevier.com/locate/techsoc

Technology adoption: A study on post-implementation perceptions and acceptance of computerised maintenance management systems

J.E. Amadi-Echendu*, F.C.P. de Wit

Department of Engineering and Technology Management, University of Pretoria, South Africa

ARTICLE INFO

Article history:
Received 31 December 2014
Received in revised form
25 August 2015
Accepted 2 September 2015

Keywords:
Technology perception
Technology implementation
Technology acceptance

ABSTRACT

Information and communications systems are increasingly being used to capture, record, store, transmit and retrieve data to manage the maintenance of equipment and physical infrastructure. The justification for the costs incurred in implementing computerised information systems subsumes that acceptance of the associated technology by the users will provide the desired future benefits to the business organisation. The study assumes that the respective organisations were ready for the implied change, and thus applied the premise that *perception* influences *acceptance* to assess the implementation of computerised maintenance management software systems in a number of user organisations. Respondents to the study indicated that *ease of use*, *usefulness* and *system characteristics* were strongly dependent on the level of training of the user during the implementation of the computerised maintenance management software system, thus reiterating that user training influences perception which, in turn, influences user acceptance of technology. A model to predict user perception is developed based on data arising from respondent feedback.

1. Introduction

Many organisations implement information and communications technology (ICT) systems to improve their business processes and operations, as well as to provide better products and services. Computerised information systems are typically deployed and utilised in business operations to facilitate reporting and decision making. In many business organisations, so called *c*omputerised *m*aintenance *m*anagement *s*ystems (CMMS) are used to capture, store, retrieve and transmit data and information related to maintenance procedures for equipment, plant and infrastructure. According to Throop [1], a CMMS is a 'software package used to track, schedule, organize and facilitate maintenance activities'. Bagadia [2] and Kullolli [4] both make the point that current versions of CMMSs are particularly used to prompt scheduled preventative maintenance actions, as well as to manage data related to the condition of equipment.

In their examination of the role of software in the management of engineering assets, Mehul and Littlefield [5] argue that computerised information systems that are properly deployed to automate business processes can improve overall firm performance. Consensus from vendors, suppliers and consultants, as articulated by Kullolli [4], Crain [6], and reference [7] suggests that a well-implemented CMMS should provide operational and cost benefits to a business. Bagadia [2,3] indicates that among other factors, user perception and acceptance strongly determine the extent of utilization of the CMMS after implementation.

Research question: *Does user perception influence the acceptance of technology, if so, how can user perception, and the acceptance of CMMS be measured?*

Research objective: *To gain some insight into how users perceive or accept the CMMS after it has been implemented.*

This paper briefly describes a study designed to examine post-implementation perception and acceptance of CMMS by users. The primary assumptions are that plausible definitions for user perception and acceptance exist, and that these two factors can be measured. The study which was conducted from the viewpoint of a CMMS implementation vendor was not longitudinal. Furthermore, the study did not consider or examine the issue of readiness of the client/user organisations. User clients were contacted to respond once-off to a survey, and the focus was on the reflexive attitudes of users to CMMSs already implemented.

* Corresponding author.
E-mail address: joe.amadi-echendu@up.ac.za (J.E. Amadi-Echendu).

http://dx.doi.org/10.1016/j.techsoc.2015.09.001
0160-791X/

2. Literature review

2.1. Technology acceptance

The acquisition of information systems is often a strategic investment for an organisation, and the implementation of the information system correspondingly induces changes in attitudes and behaviours within the organisation's internal structures. The implementation of an ICT system invariably involves and induces change, as well as to the external linkages to an organisation. Abdinnour-Helm et al. [8], and Kwahk and Lee [9] discuss attitudes that prevail in organisations during the pre-implementation phase of enterprise resource planning systems. Shivers-Blackwell and Charles [11], and aymond, Riyard and Jutras [12] developed a framework for readiness assessment but, often, both organisational and staff readiness for the impending change tends to be assumed *apriori*. Extrapolating from Timmor and Zif [10], change readiness demonstrates the capacity of an organisation to respond effectively to a new culture that may be induced by the implementation of an information system, and the capacity is embedded in the attitudes and behaviours within the organisation. Staff readiness may be described in terms of employee acumen, attitudes, and motivation, while organizational readiness may be described in terms of awareness, competence, culture, predisposition for accepting changes, and resources devoted to the implementation. In essence, the real success of any CMMS manifests in how the system is utilized post-implementation.

Although information systems provide potential to improve the performance of any organisation [13], however, the opportunities for success are often scuffled by:

i. apathetic attitudes during the pre-implementation phase,
ii. intransigent perceptions during implementation, and
iii. post-implementation reluctance to accept and utilise the associated technologies.

2.2. User perception

Alben [14] defines user perception in terms of 'quality of experience', while Colbert [16] discusses user perception in terms of 'impairment of experience'. Whereas Preece et al. [19] Al-Hammad [15], McNamara and Kirakowski [18], and Garrett [17] provide various definitions of user perception, however, we have adopted the definition (cf: [20]) of user perception as "… the process by which human beings translate sensory impressions into a coherent and unified view of …" computerised systems installed and deployed to facilitate how people perform tasks. Lucas [21] points out that the tendency for users to remain apathetic to seemingly useful computerised systems does not abate, despite the increased deployment of highly functional information technology in business operations. The reasoning from Fishbein and Ajzen [22] suggests that attitudes are often rooted in a person's beliefs, behavioural preferences, cognition, motivation, and thinking styles, and these determine how a person may perceive and/or accept technology necessary to perform a task. Although Venkatesh [23] believes that positive user perception significantly impacts the adoption and continued deployment and utilisation of information systems, however, Dillion [24] expresses the latent concern that it is difficult to isolate and exclusively determine the benefits provided by computerised information systems.

The following ontologies derived from Rogers [25] summarise issues which affect user perception of technology viz:

i. relative advantage – i.e., the superseding technology should be perceived as better;
ii. compatibility – i.e., the technology should be consistent with present standards, past experiences and requirements of users;
iii. complexity – i.e., the technology should be easily understood, learned and used;
iv. trialability – i.e., extent of testing of the technology by the eventual users;
v. observability – i.e., appreciation of the value of the technology.

The link between the perception of technology and its acceptance (see, Davis [13,27]; and Bagozzi et al. [26]) is summarised in the technology acceptance model (TAM) illustrated Fig. 1.

According to Davis [13] and Venkatesh [23], the model essentially depicts that user perception of technology comprises two related constructs:

i. perceived *ease of use*, and
ii. perceived *usefulness*.

Davis [27] makes the point that, although the perceived *ease of use* of technology may have a direct effect on the perceived *usefulness* of the corresponding information system, however, the reverse is not true, meaning that technology that is perceived as useful may not necessarily be easy to use. With regard to utilisation of technology, Dillion [24] surmised that perceived *usefulness* has a greater influence than perceived *ease of use*. Bhattacherjee [28] also indicated that acceptance is influenced by the perceived *ease of use* of a system, while Thong et al. [29] concurred that perceived *ease of use* and perceived *usefulness* both have significant impact on user acceptance of technology.

According to Al-Gahtani and King [30], and Firesmith [31], perceived *ease of use*, perceived *usefulness* and *system characteristics* work in cohort to influence user acceptance of technology. In comparison to the assertion by Rogers [25], Firesmith [31] further explains that a technology may be characterised by the following grouping of ontological constructs:

i. systems (e.g., complexity, size, distribution, heterogeneity, and variability)
ii. quality (e.g., reliability, availability, maintainability, and usability)
iii. programmability (e.g., flexibility, and customisability)

Sternard and Bobek [33], and Alkhaldi et al. [32] found that training also has an impact on how the user perceives the technology implementation. Thomas and O'Hanlon [34] point out that installing the software is only a small part of the technology implementation. The argument is that inadequate training of users can create apathy, weaken acceptance and lead to failure, especially if the training focuses on the technology itself in a manner that does not equally emphasise, for example, how the technology engenders sound business principles and practice, or how it facilitates and supports a person's method of performing tasks.

Main research hypothesis: *User perception after implementation influences the acceptance of computerised maintenance management software systems.*

For brevity, we have summarised the range of issues surrounding user acceptance and perception of technology implementations as illustrated in Table 1.

Assuming that user acceptance of technology can be measured in terms of the perception constructs illustrated in Fig. 2 (the top half of the figure is adapted from Alkhaldi et al. [32]), the four user perception constructs were then applied to measure user recollection of, and reflection on what happened during actual