Rethinking Technology Acceptance: Towards a Theory of Technology Utilization

Completed Research

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Abstract
The current paper aims at introducing a new approach in technology acceptance called “Technology Utilization”. There is a body of research in failure of technology acceptance theories to support the empirical studies. The present research suggests technology utilization; that is last phase of acceptance where the main focus is on how the technology is being used. The paper reviews the literature on technology acceptance and illustrates the need for a new approach that highlights the use of technology as opposed to its uptake. The article demonstrates technology utilization concepts through an open source software project. The paper extends the literature for theoretical supports of technology acceptance by introducing the concept of technology utilization, for further development and investigation. The paper also informs practitioners that adoption of a technology is not only about its uptake but also relates to its use.

Keywords
Technology Adoption, Utilization.

Introduction
One of the main concerns and responsibilities of companies’ Information Technology (IT) managers is assuring users acceptance of IT (Picot 2018). There is a large body of literature investigating the concept of user acceptance of IT and factors impacting this crucial matter (Turner et al. 2010; Van Wart 2017). Many of these studies were undertaken after the introduction of Technology Acceptance Model (TAM) by Davis (1985). From the introduction of TAM, IT acceptance research has merely focused on use-based view of acceptance (Dwivedi et al. 2017; Schwarz and Chin 2007). In other words, researchers have employed constructs such as “intention to use” and “actual use” to define IT acceptance. Venkatesh et al. (2003) believe that after the introduction of the Unified Theory of Acceptance and Use of Technology (which explains more than half of the variance in usage and 75% in intention to use), the literature might have reached the practical limits of our power to explain IT acceptance and usage.

TAM and its various extensions form a large body of research in Information Systems (IS) (Lai 2017). Despite the overwhelming amount of work, the literature covers mainly the technology acceptance phase.

Even though there are some articles which have studied technology post-adoptive problems (e.g., Burton-Jones and Grange (2013); Sun (2012); Ortiz de Guinea and Webster (2013)), the literature suffers a significant gap in terms of a theoretical model that covers the technology post-acceptance phase. One of the main research problems in the 80s and 90s was whether an already built information system is going to be used or not. Today, the story has changed, in most of the cases, users have no choice as to whether or not use a specific
information system. So the research problem of today is really not whether an information system is going to be used, it is rather “How the information system will be used by its users? Whether the IS is being utilized? And what factors determine an IS utilization”. This paper takes the first step in response to filling the above-mentioned gap by introducing Technology Utilization Theory (TUT).

According to TUT, more important than whether a new technology is accepted or not is how the technology is being used and whether it is being utilized by its users. The focus of TUT is on technology utilization by its various users. While the focus of TUT is on the post-acceptance phase, there are however two phases before this phase, namely, pre-acceptance and acceptance phases. The two afore-mentioned phases have been extensively researched in the literature. Most importantly, technology acceptance has been researched very extensively. Several factors that impact users’ intention to use and actual use of technology have been identified by various researchers. What we still need to know is how to determine whether a new technology is being utilized? And, what factors make the users utilize the new technology? In response to this situation, this paper introduces TUT. TUT encompasses three conceptual constructs namely, “technology utilization”, “predictive effectiveness”, “predictive efficiency”.

This paper is divided into the following sections. The next section reviews TAM and some of its later extensions. The next section introduces TUT and describes its various elements. The section that immediately follows provides a case study to illustrate the various elements of TUT. Finally, concluding remarks are provided.

Research Background

TAM and its Later Extensions

The traditional view in the adoption of technology has been an important aspect of enterprise wide systems implementation with information systems being considered to be effective and efficient tools to gain organizational competitiveness (Gangwar et al. 2014). However, in recent times an important question has been “why have sufficient results not been achieved in spite of the fact that the organization has made huge investments in information technology?” (Turner et al. 2010) This has opened a new avenue of research which seeks to evaluate the information systems from different perspectives. Researchers who have studied the topics such as information systems (IS) adoption have all tried to somehow evaluate the value of the information system. Below briefly reviews major steps in the literature towards the topic of IS adoption (Bakshi, 2013; Talaei-Khoei et al. 2012).

The most popular theory which has been offered with respect to technology acceptance is Technology Acceptance Model (Davis, 1989). Research on IS adoption started following the work of Davis (1989) that proposed Technology Acceptance Model (See Figure 1). TAM was developed based on the Theory of Reasoned Action (Ajzen and Fishbein 1988) and it is one of the most influential IS theories that explains users’ adoption of technology (including information technology). TAM posits that the acceptance of technology is driven by two main factors: perceived usefulness (PU) and perceived ease of use (PEOU). Perceived ease of use and perceived usefulness are behavioral beliefs and lead to an individual’s behavior intention and actual behavior.

![Figure 1. The Technology Acceptance Model (TAM) (Davis, 1989)](image-url)

There are various extensions to the Technology Acceptance Model (Marangunić and Granić 2015). For instance, some scholars proposed adding further factors into the equation, such as subjective norm,
perceived behavioral control, and self-efficacy to the main model. Other scholars brought some further belief factors like trialability, visibility, and result demonstrability into the model from the diffusion of innovation literature. Others suggested the addition of some moderating variables into the model, such as demographic characteristics and personality traits (Venkatesh et al. 2003).

Among researchers who have suggested extensions to TAM, Wixom and Todd (2005) model adds additional belief factors, factors from related models and some external factors. Figure 2 demonstrates this model.

![Figure 2. The Extended TAM (Wixom and Todd, 2005)](image)

TAM2 was introduced by Venkatesh and Davis (2000) sought for drivers other than PU and PEOU. TAM2 added social influence factors (such as subjective norm) and cognitive instrumental processes (such as job relevance and result demonstrability) as antecedents to PU to enable a better prediction of information technology acceptance. According to TAM2, “people use a mental representation for assessing the match between important work goals and the consequences of performing the act of using a system as a basis for forming judgments about the use-performance contingency (i.e., perceived usefulness) [p. 191]” (Venkatesh and Davis, 2000). Figure 3 presents the extended Technology Acceptance Model (i.e., TAM2).

![Figure 3. The Extended Technology Acceptance Model (TAM2) (Venkatesh and Davis, 2000)](image)

**Evidence Inconsistent with Extant TA models**

There is a body of literature that demonstrates the evidence that technology acceptance is unable to predict and justify technology uptake behaviors. Tarhini et al. (2015) systematically review the literature
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and list the empirical results that cannot be justified by Technology Acceptance models. Legris et al. (2003) conducted a meta-analysis on existing TAM-based models that have failed to describe users’ adoption. Davis et al.’s (1989) study Perceived Ease of Use was not found to impact user attitude. Behavioral intention as one of the basic constructs of Technology adoption has been shown ineffective to predict actual use (Turner et al. 2010). Similarly, in another study, the association of perceived usefulness and actual use could not be proven (Gefen and Keil 1998).

Of the contextual applications of Technology Acceptance Models, the literature could not support the impact of Perceived Ease of Use on Perceived Usefulness and attitude in the physicians’ use of medical technologies (Hu et al. 1999). Vichitvanichphong et al (2018) found that most of the papers in adoption of assistive technologies among seniors have not used any theories to frame the research or elucidate their results. For those that they have used, the adoption theories failed to demonstrate their effectiveness in predicting the users’ adoption.

The evidence above could demonstrate a need for more attention to be paid with respect to theoretical support for the studies and to improve the reliability theoretical lenses in adoption. In a closer look at the theories, we suggest that despite the great attention in literature to adoption of technology, how the technology is being used/utilized has been largely ignored. We provide an example of an online learning management software.

**Technology Utilization Theory**

**Technology Utilization as a Phase of Technology Post-Acceptance**

We argue that what is more important than accepting a new technology (e.g., and the extent or frequency of use) is how the technology is being used and whether it is being utilized by its users. As opposed to may prior articles, this current study focuses on the level of utilization by various users of a technology. The two important phases of pre-usage and usage have been extensively researched in the literature (e.g. in TAM related studies), that is why the focus of TUT is on post-usage phase. Today we know a large number of factors that affect users’ intention to use and actual use of technology. What we are yet to know is how to determine whether an information system is being utilized? And, what factors impact an IS utilization?

Figure 4 shows the three afore-mentioned phases.

![Figure 4. Various phases of technology acceptance](image)

Oxford dictionary defines “utilization” as “make practical and effective use of [something]”. Here the question is how the users use the technology as opposed to whether they use it or not. Not every use of technology by users is ideal for managers. Of course, managers are looking for effective use of technology by their employees. This way, technology utilization means “exploiting as much functionalities existing in a given technology as required towards supporting the users’ tasks”. This means maximizing the benefits of the technology in supporting users’ activities and tasks.
Technology utilization is a process that has a significant impact on the survival of the firm, particularly in today’s high technology market where technological changes are rapid and often dramatic. There is a large body of literature that demonstrate that inability of firms to maintain their competitive advantages from available technologies resulting in failures (Varzaly and Elashmawi 1984). We argue that, this can be resolved focusing on the utilization of technology as opposed to simply using the technology. Technology utilization refers to operationalizing the functionalities of a technology in its application to achieve instructional goals in a given situation. Technology Utilization highlights the role of users’ assessment of currently adopted technologies to address scenarios on where to best leverage the use of adopted technologies. TU seats in the post-technology adoption phase. TU refers to the process in which users utilize an adopted technology in the business. This may not necessarily include all the functionalities of the technology, but would demonstrate the role of the technology in the business process.

We may have a very good information system which is being used to a large extent or very frequently by its users but not in an ideal way. Thus, having a good information system per se is not enough, we need a good information system which gets utilized by its users. This way we can make sure that we are utilizing the information system in order to support our organizational processes and tasks. That is why technology utilization matters. IS literature indeed lacks research that investigates IS utilization by its users. Here, we call for future research on technology utilization that take this work as a first step and seek to operationalize the construct of “technology utilization”, and investigate its antecedents in various IS contexts.

**Forms of Technology Utilization**

Technology utilization might happen in two forms. The first form of “technology utilization” happens when an individual user utilizes a given technology. For example, an individual user who has adopted a specific statistical software will have utilized this software if s/he exploits as much features of the software as required to perfectly conduct the analysis and retrieve the desired reports and diagrams. The second form of “technology utilization” happens when a user within an organization utilizes a given technology. For instance, let’s assume that a specific university has adopted the latest version of Blackboard as its online tool for learning and teaching. A lecturer who knows how to effectively use various features of the software that are related to his job description (e.g., how to put up course materials, lecture notes, and assessments; how to make online quiz; how to respond to students’ queries through discussion boards and forums; and how to make announcements to the students) has obviously the potential to utilize the Blackboard technology.

When a user utilizes a given technology, two parties benefit most: the individual user, and the user organization. The utilizer user benefits because s/he succeeds to fulfill his/her tasks. Furthermore, the organization takes benefit because the user’s task gets done successfully and the expected outcomes are achieved efficiently.

**Operationalizing Technology Utilization: Predictive Effectiveness and Efficiency**

In the Technology Utilization Theory, utilization is determined by two factors of the predictive effectiveness and the predictive efficiency (as illustrated in Figure 5). Effectiveness means capability of producing an effect. In other words, effectiveness means getting the right things done (Nichols 1999). Predictive effectiveness means the expected effect or impact of the specific technology. On the other hand, Efficiency simply refers to the extent to which we create output out of particular amount of input (\( \text{Efficiency} = \frac{\text{Output}}{\text{Input}} \)) (Nichols 1999). In other words, efficiency means doing things in the most economical way. Predictive efficiency means the expected output created out of particular amount of input (e.g. cost, time) for the specific technology.
Simply put it is argued here that technology utilization is composed of two critical elements of predictive effectiveness (which is determined by the users’ perception on the outcome or results which using the specific technology is going to create for them), and predictive efficiency (which is determined by the users’ perception of the amount of resources such as time and effort that they need to put through using the technology).

It is arguable that the success of a technology is not necessarily about its deployment but it is more about the effective and efficient use of technology functions in the processes, that is called Technology Utilization. In the next section the TUT concepts are demonstrated using an example technology product.

**Exemplar**

This section illustrates TUT through a case. The technology which this case study about is Open Source Software (OSS). OSS development model is actually a re-emergence of the original development model involving publicly sharing program source code (Stallman 2002). OSS is a technology which was coined in February 1998 by a group of “free software” proponents, such as Tim O’Reilly (Midha 2007). Many researchers have studied various aspects of Open Source Software including its user acceptance and success (eg. Ghapanchi and Aurum (2011), Crowston et al. (2006), and Ghapanchi et al. (2014)).

This research focuses on a successful OSS project hosted on Sourceforge.net, one of the largest OSS hosts in the world. The project of our case study is called OrangeHRM and is a Human Resource Management (HRM) system that facilitates personnel information management, employee self-service, leave, time and attendance, benefits, and recruitment of a company. With over 1 million downloads, OrangeHRM is also fast becoming one of the most widely used HRM applications in the world. It believes in providing users simple to use robust software, and iteratively improving it based on feedback we get from them. This rapid evolving of the product is driven by agile development practices, and weekly product releases to SourceForge.

OrangeHRM was registered on Sourceforge on 2 January 2006 and was chosen as the project of the month in December 2008. Its intended audience is mostly end users. By August 2009, OrangeHRM has been downloaded more than 260,000 times through Sourceforge.net; and by February 2018, it has been downloaded more than 1 million times. OrangeHRM has been translated into five languages of Danish, English, Dutch, German, and Spanish. Importantly, 22 core developers are working on this project (as of 17th August 2009). Figure 6 shows some details of OrangeHRM project. In what follows the various post-acceptance behaviours in TePAM are illustrated through OrangeHRM case.
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Human Resource Management (HRM) is an organizational technology as opposed to an individual one. As was mentioned before, “technology utilization” is defined herein as “exploiting as much functionalities existing in a given technology as required towards supporting the users’ tasks”. Let’s focus on an individual user within an organization who uses the leave management functionality of a HRM software (e.g., OrangeHRM) to manage his leaves. Let’s also assume that leave section of the software has 4 features of “apply for a leave”, “leave policies”, “leave balance” and “leave history”. If the assumed user just uses the “apply for leave” feature, he is obviously using but not utilizing the technology. But, he could use all 4 features of leave, he could use:

- “apply for a leave” to request or forecast for a leave,
- “leave policies” to understand related policies and procedures,
- “leave balance” to find out how much leave he has available (e.g., in terms of family leave, recreation leave or sick leave),
- and “leave history” to review his leaves in the past.

Simply interacting with all 4 features of this system per se does not necessarily mean that the person is utilizing this technology. As per the definition that we provided for technology utilization which is “exploiting as much functionalities existing in a given technology as required towards supporting the users’ tasks”, the user is only utilizing this particular technology if s/he not only use but exploits various features of it relevant to that user towards fulfilling his needs and tasks. In other words, this technology is said to be utilized if it tends to maximize its benefits in supporting users’ activities and tasks. The key word here is the use of features relevant to supporting the users’ tasks. If only half of the features of the system are relevant to the specific user’s tasks, then s/he only needs to make effective use of those features to be utilising the system.

The case above demonstrates the applicability of technology utilization theory. The main objective was to illustrate the need for such a theoretical ground in which the emphasize on the utilization of technology functionalities can be grounded. In addition to the illustration purpose of this case, technology utilization showed situations in which the technology adoption as well as the post-technology adoption theoretical concepts are unable to justify the predictive effectiveness and efficiency. The exemplar above and application of TU used to address the short-fall of literature discussed earlier on prediction of actual use.

Conclusion

The reader of this paper may well say “not another critique of technology adoption models”. However, we believe that in certain areas such as how a particular technology is being used i.e. utilized as opposed to
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technology adoption, the literature requires further attention. The information systems discipline, through its apparent condoning of technology acceptance models regardless of context, somehow lacks of out-of-box thinking.

This paper suggested the concept of technology utilization as an important phase to technology acceptance. The article explained different behaviors possible in technology utilization and discussed the impacts of these behaviors. The present paper introduced a new approach to technology acceptance and operationalized technology utilization through two antecedents of predictive effectiveness and predictive efficiencies. The study demonstrates the proof of concept through an exemplar. While exemplars are common approach in proving the applicability of a newly introduced concept, they lack the validation of the approach in mass production environments. Although in the current paper, the exemplar was used to demonstrate the relevance of technology utilization approach, we admit that the proposal of this paper is untried in real scenarios for different domains. The exemplar used in this study suffered from simplicity and difficulties for generalization that can be addressed by future empirical studies.

REFERENCES


