

The impact of information systems on user performance: A critical review and theoretical model

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Abstract-With the recent growth of applied information systems (IS) in business organizations, investigating IS impact on user's performance and productivity is essential for both practitioners and researchers. Early efforts concentrated on the identification of factors that facilitated IS use. This produced a long list of items that proved to be of little practical value. It became obvious that, for practical reasons, the factors identified had to be formalized into a model in such a way as to facilitate analysis of IS use. Thus, in this study we are exploring the similarities and differences among various IS models with a goal of developing a combined model with more explanatory power to better understand IS impacts on end user performance. A proposed model is presented linking information quality, system quality, user characteristics and task technology fit to evaluate the impacts of IS through ease of system use and usefulness on user's performance. The current study consolidates three models that have previously been validated separately in IS. Evaluated together, these models can provide a better understanding of the way in which IS influences user performance in a broader variety of circumstances.

Keywords: Information system, User performance, System quality, Information quality, Task technology fit, User characteristics.

I. INTRODUCTION

In the last decades, the linkage between information systems and users' performance has been an ongoing concern in IS research. Practitioners and researchers have a strong interest in enhancing their knowledge of IS and users' performance [18]. This knowledge is valuable as it can help in the development of better methods for utilizing IS and evaluating their impacts on the organization and user performance.

Researchers studied IS impacts on organization and individual. Among other things, strategies, structures, productivity, work design and individual tasks, all have been considered [129]. However, the research done so far is by no means exhaustive.

These largely independent streams of research led to our interest in explicitly exploring the similarities and differences among models and constructs that help IS researchers understand users aspects about the IS they use [132]. Research on integrating these models and constructs is beginning to appear in the literature. For example, the call for research on the antecedents of the TAM external constructs perceived usefulness and perceived ease of use, by [38] has generated follow on studies [125].

There are a large number of IS evaluation frameworks investigating different aspects at both organizational and individual levels. These efforts have identified some main aspects and relationships in this area however, the literature lacks an examination of the consequences and the previous efforts so far have restricted their focus to the determinants of acceptance and user satisfaction. The lack of a conceptual framework and integrated model has motivated this study.

As a result, the aim of this study is to review the literature and subsequently develop a revamped framework to evaluate IS's impacts on user' performance. The study, will also assess the most important factors that affect user performance in an IS environment.

Furthermore, the study combines different evaluation variables and their subsequent classification into structured dimensions and factors which represent a further step in investigating IS and its impacts on user performance as well as enhance knowledge about IS and users' performance.

II. SIGNIFICANCE AND CONTRIBUTION

Organizations need to build a rigorous approach to properly assess the impacts of IS on performance. Such awareness could help improve performance efficiency and effectiveness associating the actual benefits of IS to performance. Determining the critical factors that shape the essential impacts from the user perspective by formulating a framework to conceptualize the benefit of IS to the individuals and organizations.

The early efforts concentrated on the identification of factors that facilitated IS use. This produced a long list of items that proved to be of little practical value.

It became obvious that, for practical reasons, the factors had to be grouped into a model in such a way as to facilitate analysis of IS use [90]. Previous models such as TAM and TTF overall do not explain the whole story about the system use and impact on individuals. Analysis of empirical research shows that results are not totally consistent or clear. This suggests that significant factors are not included in the models. While there appears to be agreement amongst academics on the usefulness of the models, integration into a broader one which would include variables related to both human and social change processes [90], IS factors [16] and also information and technology factors [77] remains elusive.

Conflicting results from previous research in the IS and its influence on performance have motivated this study of the potential impacts and values of the IS for users [40]. In addition, a recent concern has appeared about the quality of information systems, information quality and their impacts on user performance.

This research has potential to make a significant contribution to the IS literature through confirming the role played by certain variables identified in the research literature as determinants of user performance and the relative importance for each variable. Other contributions will take the form of bringing to the fore the influence exerted by technological factors such as IS support and IS training. Examining the IS elements that impact users' performance signifies a new step which will lead to a better understanding of what has been reported in the literature and open a new path in this area.

This study moves the focus from technical and organizational perspectives to a user perspective and therefore from implementation and success factors to more important issues related to the user, who creates value and outcomes from IS.

In short, the research on IS and performance is still a growing field, but has reached a level of maturity in some aspects, such as user satisfaction. However, the lack of conceptualized frameworks and the critical call for validated measures necessitate conducting more research to explain in more details the IS user relationships.

III. LITERATURE REVIEW

Researchers have studied the impacts of IS on performance and among other things, the impacts of IS on individuals and organizations, strategies, structures, productivity, work design and individual tasks, all have been considered [112], [136], [102], [120], [36], [52], [98], [23], [82]. Some of these studies have stated positive relationships between IS and performance [99], [127], [6], [82], [122], [63], while other studies have stated otherwise [83]. While the assessment of IS Success is consistently reported by organizational executives throughout the world as a key issue, there is little consensus among practitioners or researchers on how best to measure the impact of IS in organizations

Although these studies identified the broad nature of the impact of IS on individuals, they contain many contradictory and inconclusive results about the consequences of the IS and its impacts on individual performance [83]. They indicated that on average, information systems are associated with enhanced performance with considerable heterogeneity in the across firms and domains [115]. Furthermore, most research has focused on identifying determinants of computer acceptance which may be inadequate in determining the impacts of various IS applications on user performance and testing the relationship between IS and its user [30], [137], [3], [138], [83].

Consequently, a careful scan of the published IS and performance research was carried out.

A summary of the previous IS and user performance studies and the main factors that have been investigated are illustrated

in appendix (A). We found that previous studies can be categorized as follows:

- A. *The impact of IS on user's job and task performance*
- B. *The impact of IS user performance*
- C. *Factors affecting and user performance*
- D. *User satisfaction and user performance*
- E. *Measuring IS impacts on user performance*
- F. *Approach used to measure IS impacts on user performance*

A. *IS and its impacts on user's job and task performance*

Information systems are thought to have significant impacts on users' jobs. Researchers have studied the impacts of IS on the users' job from different perspectives by using different approaches [71], [119], [23] and by measuring several factors, which include changes in the importance of the user's job, amount of work completed and accuracy of the job. Some studies confirmed that information systems increase productivity and improve performance and outcomes [139]

More specifically, some researchers studied IS impacts on user's tasks and the way users implement the task [36] They have stated that IS also affects task performance, task structure, time taken to perform tasks and quality of task performed [82]. Some empirical studies reported a strong relationships between IS and quality of work [83], [33], [31], [99].

[33], provided a new direction for both practitioners and researchers by investigating the fit between IS, user needs and task requirements, [82] which in turn affect user performance. Although they provided significant insights about IS impacts on user's performance and explained how IS adds value to individual performance. Many issues should be taken into account when investigating IS and user performance as discussed later.

B. *IS impact and user performance*

The impact of information systems on end-users performance and the relationships between information systems, performance and productivity have plagued IS research [23] A noticeable amount of research was associated with end user performance, starting with Davis [43] in the technology acceptance model. [131] identify six major categories of information system success: system quality, information quality, use, user satisfaction, individual impact, and organizational impact [92] in his extension of DeLone and McLean's work defined further the categories and added several more variables.

Despite the large number of studies in IS and performance during the last two decades, demonstrating the IS effects on performance has proven extremely difficult [1], [111]. This relationship is multidimensional and includes many aspects, such as user job, task and other aspects as discussed below.

[84], studied the relationships between IS and user performance by investigating several variables including

system use, system quality, information quality and user performance. They indicated that the above factors affect user performance in these organizations positively. The results also suggest that user satisfaction is an important factor affecting system usage and has the strongest direct effect on individual performance.

[16], examined many factors that affect user performance by integrating many variables from different perspectives to test whether or not these factors contribute to improve user performance. These factors include system, data model, tasks characteristics and user characteristics. They stated that these factors affect user performance positively. However, they mentioned that some factors probably affect outcomes more than others.

Recently, [102] have investigated the impacts of IS on individual performance in a more comprehensive model linking information quality, system quality, and tasks performed. The results indicate that information quality and system quality affect tasks performed by individual.

Some researchers go deeply and investigate specific parts of the information systems on user performance. They examine in detail the system quality dimensions on end user performance, for example [124] stated that system response time is very critical to user performance. His results proved that system response time affects user performance positively.

Researchers have even tried to control these variables more to identify their impact on user performance and productivity accurately, e.g. [14] identified the impact of upgrades in processing speeds of personal computers on end-user productivity. It was observed that end-user productivity (as measured by an increase in the amount of work completed) has been improved. The idea that these studies have introduced very important highlighted some important factors that interact and overlap with each other to affect user performance. In addition, the research expanded the call for a new comprehensive model and/or an update of previous models for geared towards a new empirical investigation about IS impacts on user performance.

In conclusion, research on end user performance has relied on dispositional factors such as attitudes and attentions to examine IS impacts and predict end user performance [54], which lead to more argument and ambiguity. By contrast, [57] have investigated the effects of situational factors on end user performance. They examined the influence of IS user-friendliness on end user performance and reported that subjects using user-friendly software made fewer errors than those using software, that was less user-friendly.

On the other hand, the system itself may affect user productivity and perception; previous studies have also established strong links between system, task, satisfaction and performance [112].

C. User satisfaction and user performance

Considerable research has been devoted to examining information system success and user satisfaction. Numerous

papers have been published on the topics of IS success, evaluation, effectiveness, and acceptance. Since the D&M model was first introduced [133], [39], [74].

User satisfaction is a useful way to look at the previous studies in IS and user performance. In this sense these studies focus on identifying the conditions under which users are satisfied with the systems they use. According to these studies user performance is affected by user satisfaction ([84], [133], [134].

It should be mentioned that previous research has used system usage and user satisfaction to measure system success, and the TAM variables to predict usage of information systems. However, researchers later on suggested that TAM variables may be not sufficient predictors of system usage and success.

What is important in these studies in this regard is they used user performance or, what is called sometimes individual impact as an indicator to system success or system effectiveness.

These studies opened the path to use theories from other disciplines to explain the IS impacts on individual performance. However, the way they examine individual impacts is limited. The performance aspect is ambiguous as they focus on user satisfaction and system use to measure the system impacts, which is not adequate to identify the value and the actual benefits of information system in various environments. The studies ignored other significant factors, which have been found to affect performance, as discussed below.

D. Factors affecting and user performance

One of the continuing issues of IS is that of identifying factors that cause or create impacts of systems developed and implemented on user [19]. Over the decades, various theories and approaches have been put forth to address this problem. This represents another beneficial way to look at previous works, through the factors that have been measured and investigated formerly as the purpose of this study is to investigate the IS impact on user performance.

As mentioned previously each stream of the previous studies tells a part of the story. However, previous research paved the way for studies about some factors that should be further investigated as critical factors to user performance [12]. According to these studies, there are many variables in IS environment that affect user performance directly and indirectly. In this view, as illustrated in Appendix (A), system use, system quality, information quality, usefulness, ease of use, task –technology fit, user satisfaction, and intention to use, user characteristics and task characteristics were the most repeated independent and moderating variables that probably affect on user performance.

Interestingly, none of the previous studies has provided a set of the most important variables or factors that control the relationship between IS and user performance, but some of them investigated some of the aforementioned factors separately. The need for further investigation about these factors and the way they influence user performance is

extremely valuable, for both academics and practitioners, which might help these stockholders to obtain a more comprehensive view and improve our understanding about the way IS influences on user performance and thus optimize the utilization of IS in organizations.

Fascinatingly, literature shows that a huge amount of research has investigated the impact of IS application on user performance by adopting previous models from IS literature such as TAM and TTF to examine the system success and user evaluation of these systems. These studies have been applied in various settings and sectors, although they have common factors and results [49], [55], [44], [106], [28], [37]. Others studies tried to build a new approach or method as apart of the study to measure IS impacts .In addition some studies just tried to validate models or measurements. However, most of these studies mentioned that system quality and information quality are critical factors when evaluating IS impacts on user performance.

On the other hand, EU and PU have been investigated as moderating variables, while other studies have merged them either as independent variables or as a part of the system quality but at least they could identify that PU and PEU as important variables when studying IS impacts. In other words, they open the path for more research in this area by introducing new variables, or by proving the relationships between some of these variables.

Lately, some previous studies used TTF model alone, or with other factors adapted from other models and or to test the fit between IS applications, user needs and task requirements in different settings, while some of these testing the model itself by applying in various settings. They usefully determine that the fit should be evaluated when investigating IS impacts on user job and performance. It is should be mentioned that few studies have integrated TAM and D&M models to identify a wider model to evaluate user performance [66], [89]. Moreover, they have employed several methodologies to explain the relationship between IS and user performance.

E. Measuring IS impacts on user performance

Validity and Measurement development was one of the most important aspects in IS research although it has not been given enough attention in the literature. Only few researchers have devoted serious attention to this issue ([141], [135]). This might be due to the rapid change of IS, or because of the feeling that IS issues must be handled with dispatch, as stated by [135]. However, researchers have used the limited validated measures broader and tried to validate them in various information systems environments such as decision support systems [87] world wide web [75] and ERP system environments [37], [5]. The purpose of the limited research in this area was to develop new measurements to measure IS impact on user performance [142].

Some of these studies used TAM and TTF constructs to create or to validate reliable measurements to explain such a relationship between various types of IS and individual performance ([56], [44], [31], [88], [4], [84]; [60], [35]).

In brief these studies established many validated measures for further research in different IS contexts. They could facilitate the progress of new research by providing reliable measurements and valid instruments and also by providing a new approach to study IS impacts in a more profoundly fashion.

F. Approach used to measure IS impacts on user performance

Researchers have used several approaches to study IS and user aspects by employing different theories that have been derived from different disciplines. One of the most commonly used approaches is the *Organizational behaviour approach*, or what I would like to call "*behavioral approach*" which originally comes from behavioural and social psychology setting through TAM, Theory of Planned Behaviour (TPB) and Theory of Reasoned Action (TRA) and other models. These models have been used widely in the IS field to investigate behaviour aspects [145].

In this regard the TPB has been proven to be a successful model in a wide range of behavioural disciplines to empirically predict and understand behaviour in a variety of situations. The TPB constitutes a general model for explaining users' behavior according to the relationship between beliefs, attitude, intention and behaviour.

The development of TPB is originally based on the theory of reasoned action [145] which is designed to interpret human behaviour. This theory has been proven successful in predicting and explaining human behaviour across different applications environments.

In particular, it is an extension of the Theory of Reasoned Action which focuses on those cases where users have no complete control over their choice but are somehow conditioned by Non-motivating factors related to the availability of certain requirements and resources [26].

According to this approach a person's actual behaviour in performing a certain action is directly guided by the person's behavioural intention, which is jointly in turn determined by attitude toward the behaviour ([20], [51]).

According to TAM and TBA, improvements in perceived ease of use may contribute to improved performance. This internal belief ties in with an individual's assessment of the mental effort involved in using a system ([146], [43]). Perceived usefulness is an important belief which provides a diagnostic insight into how attitudes toward using and the intention to use an information system are influenced [147]. Perceived usefulness has a direct effect on intention to use, over and above its influence through attitude [145].

In IS context researchers employed the behavioral approach to better understanding user behaviors, system use, system impacts and satisfaction and their subsequent effects on user aspects specially user performance within various types of information system environments. More specifically, they analyzed how users act and how user's attitudes and attention lead to use information systems [97], [88], [4], [106], [95] [62], [103], [127].

Recently, [4] have argued that this approach could be useful to examine the context of a new IS implementation in an organization. It could be also used to examine IS usefulness, user evaluation and even user expectation associated with IS and job aspects according to [26]. Indeed, researchers utilized this approach to analyze different user behaviors in various IS environments and situations, such as the acceptance of the World Wide Web user behaviors, the adoption and use of new IS services [51], [26], [88].

The argument in this approach was that since an objective measure of the benefits of IS was difficult to achieve, user acceptance could be used as a surrogate to measure the impact of IS [109]. Although this approach is still extensively used by IS researchers it has some recognized limitations and has been criticized by other researchers, as mentioned previously, particularly with the enunciation of new behavioral and IS adoption models [51], [97], [103]

In conclusion, prior research that used this approach has reported inconsistent results. While a stream of them failed to find a relationship between attitudes and end user performance in particular system environments, other has reported the relationship to be positive or [54]. The first stream of studies integrated the concepts of TAM into the expectation disconfirmation model to explain and investigate user behaviour based on users' expectations of systemic attributes [20]. The results of this stream indicated that users expectations affect intention and attitudes to use a particular system. This in turn affects system impacts on user behaviour and system usage [143].

However the other stream claimed that some internal and external variables might play a vital role in determining the system impacts on user behaviour, such as system use.

As it needs to be pointed out that none of these approaches has achieved universal acceptance, as each one presents particular strengths and weaknesses [26]. Researchers keep developing and decomposing new models alternatively to better understand user behaviour and to explain individual use after users have exceeded their initial usage [102], [113].

In conclusion, previous research on end user performance has relied almost exclusively on dispositional factors to predict end user performance such as satisfaction, attitudes. They rarely include situational factors such as user characteristics and system quality on end user performance. The absence of situational factors is a major limitation of previous research. The situational factors have been believed to affect user performance directly and indirectly by affecting other factors on user performance [54]. In other words, the view of previous research was very restricted by few variables, while many important variables have been ignored.

Importunately, most previous studies have investigated user performance as an indicator factor to organizational impacts or system success factor.

Consequently, the omission of the comprehensive model to evaluate the impacts of IS and its dimensions on user performance is still as an inherent problem in IS field which makes the desire for an academic sound to this need is highly appreciated. Furthermore, based in this literature review user aspects have been absence due to lack of conceptual framework and the lack of set of measurements for most variables in this area.

IV. PREVIOUS DEVELOPED MODELS AND FOUNDATION

Before presenting our proposed model, we review the literature on existing models and constructs for studying IS impacts on user's aspects.

From the mid-eighties, IS researchers have concentrated their efforts in developing and testing models that could help in predicting system use, system success and user aspects. Consequently, a number of models for studying information systems utilization and impacts on end users in have developed [120]. The most commonly used models are, the Technology Acceptance Model (TAM), the Task-Technology Fit model (TTF), and DeLone & McLean model (D&M). We are exploring the similarities and differences among these models with a goal of developing a combined model with more explanatory power to better understand IS impacts on end user performance.

Indeed, these models provide a much needed theoretical basis for exploring the factors that explain IS benefits and its impacts on user's performance [89]. More specifically, Davis, [39], [41] introduced (TAM), which postulates that information technology impacts on user performance are determined by perceived usefulness and perceived ease of use [66]. The idea that, external variables such as personal features, system features support and training can affect behaviour [18] which in turn affects system use and user performance [128], [18].

Researchers over two decades have replicated, extended, and used TAM but there are some aspects which remain unclear such as system impacts on user aspects. Some studies found considerable impacts of it on the users aspects. However, others did not find significant effects [91], [64]. Some studies have modified TAM to examine system use and user performance, for instant [75]. In contrast, other studies added a new argument in this matter [95] compared many models to study IS with user performance. They decomposed new model which combines (TAM) and (TPB). The results indicated that the decomposed model performed slightly better than individual models.

On the other hand, D & M's model concentrates on the system quality, information quality and system use with user performance. They identified the complex reality that surrounds the identification and definition of the IS success and its impacts on the performance. They propose that "system quality and information quality singularly and jointly affect user performance by affecting system use and user satisfaction.

Eventually, previous studies that applied D & M's model could achieve valuable contributions to the understanding of IS performance impacts and provide a scheme for classifying the different measures to interpret the linkages between IS and individual performance [70], [93], [102]. Although some of these studies have supported TAM's validity and reliability and achieved reasonable outcomes. D & M's model has been criticized and modified by many researchers to overcome some weakness or to adapt with other systems' environments [22]. [81].

Later on [33] tried to bring a new contribution to this field by introducing TTF model which supports the argument that when there is a fit between user task and the feature of the IS, benefits of the system tend to be high and user performance will be high and vis versa [12], [76].

A large stream of studies has used this model to explain the impact of information systems on user performance ([89], [12], [120], [81], [45], [80], [76]. Earlier TTF studies employed this model with a very tight view to individual performance and the usefulness of the system [89]. This necessitates the integration between TTF and other models or modifies it to produce a new model that should be wider and more applicable in different situations. Furthermore, the difficulty and complexity in measuring actual IS impacts on performance led many prior studies to use multiple perspectives and theories to reach more accurate and rigorous results [109].

Eventually, TAM and TTF overlap in a significant way and they could provide a coherent model if they are integrated, such that model could be even stronger model than either standing alone ([66], [89]. On the other hand D&M's model and TAM are interrelated. That is to say, TAM investigates the possible effects of EU and PU of the system and how they in turn can affect user performance D&M model specifies the software quality and outputs factors of the system or/ and application itself that create the usefulness of the system, which in turn affects user performance as well as ease of use.

Interestingly, some studies simplified some of these models by removing some constructs or adding others [131], while others tried to extend these models by using different approaches to meet new requirements or research purposes. These attempts introduce new related factors from other models or alternative factors, or examine antecedents and moderators [51]. They used this approach to test the relationship between several IS applications and user performance.

A. LIMITATIONS OF PREVIOUS MODELS

Although previous models have shed some light on the links between information systems and user performance, they *still have some limitations*. At the same time they necessitated the need for more comprehensive view of IS and performance. Particularly, TAM has been criticized because of the lack of task concentration and even the elaborateness of focus on utilization of IS as a voluntary. However, utilization means for many users more a function of how jobs are designed than the

quality of the IS. Therefore individual performance is affected by TTF rather than utilization [33]. Additionally, there is only a little explicit recognition that more utilization of a system may not lead to higher individual performance. That is to say, the utilization of a poor system will not increase individual performance.

Poor system may be evaluated extensively as utilized by users due to other factors such as accessibility and personal characteristics [33]. TAM does not address how other variables affect core TAM variables, such as usefulness and ease of use [3]. In other words, it paid insufficient attention to understanding other factors, such as system outputs and system itself, which impact the major variables in TAM [27]. Furthermore, TAM does not provide enough concern to very important element which is related to the system quality and utilization before a system delivers performance effects. The idea that system usefulness must be evaluated before IS can deliver performance impacts [33], [31].

In conclusion, previous models offer valuable contributions to understanding of IS impacts. However each one tells only part of the story [51]. Thus, it became obvious that, for practical reasons, the factors had to be grouped into a model in a way that would facilitate analysis of IS use impacts on performance. This suggests that significant factors are not included in the models. We conclude that TAM is a useful model, but has to be integrated into a broader one which would include variables related to both human and social change processes, and to the adoption of the innovation model.

Similarly, TTF suggests some constructs that are relevant to investigation. However, TTF does not answer the question of what aspects of IS lead to the highest levels of user performance [12]. To overcome these weaknesses, this model integrates the three models to produce a new synthesized model which has more comprehensive view of the most important factors that affect user performance. In general, previous studies stated the necessary of integrating these models to synthesize new comprehensive one which might be useful for different situations and serve several purposes at the same time [66], [89]

B. JUSTIFICATIONS AND THEORETICAL SUPPORT

Understanding IS and system dimensions impact lies in understanding how these elements interact and affect user's performance by providing the fit and support to user task needs [89]. Extending TAM, TTF with D&M models provides profound explanation and holds much promise to reach better understanding for the variance of factors that affect user performance than any of these models alone.

Prior research has examined TAM, TTF and D&M separately, to the best of our knowledge; no study has yet theoretically and empirically compared or contrasted these three models simultaneously. Therefore, it opens up the paths across the avenues of TTF, TAM and D&M antecedents which were viewed separately as distinct parts, with no linkages among them. However, there are theoretical reasons and empirical

support for the existence of linkages across these constructs [79].

The synthesized model as illustrated in Fig. 1 below might help researchers and practitioners understand the TAM antecedents, and understand how to provide IS, that is perceived to be useful and easy to use [120]. TTF model directly affects utilization of technology which is a major contribution of TTF, since TAM focuses on the technology more than the ability of the technology to support users as they perform their tasks, which is the core focus of the TTF model. That is, by integrating the two models it is possible to reach a more comprehensive view on the IS and user contemporaneously.

The model might allow this study to achieve new contributions because TAM only indirectly considers how the IS tool supports the user's task through the PU and EU [120]. Additionally, personal characteristics were linked as control variables to examine the dynamic effects of these variables which have not received enough concentration in the previous research.

It also allows organizations to identify major areas of SQ, IQ and TTF with the use of a given application that affects their employee's performance. Similarly, the overall items that measuring user performance enable organizations to assess if the system achieves its goals or not, and or improves user performance.

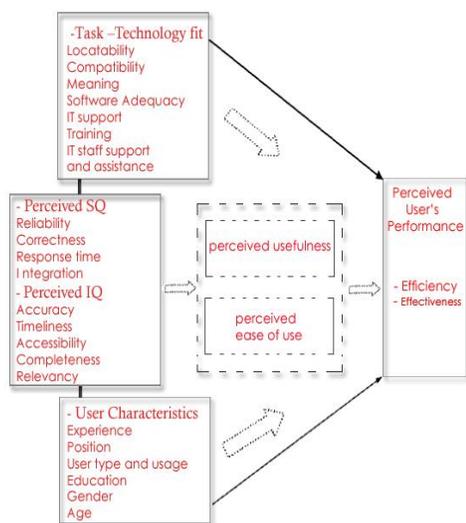


Fig. 1 The proposed model

V. CONCLUSION

TAM, TTF and D&M modes have been proven to be useful theoretical models in helping to understand and explain system impacts and use behaviour in IS field. However, reviewing of previous research using these models separately shows that results are not totally consistent or clear. This suggests that significant factors are not included in these models.

We conclude that these models are useful models, but have to be integrated into a broader one which would include variables related to technology, system and human contemporaneously. The result of combining the two models provided a better model of IS utilization than either an attitude or a fit model provided alone. Consequently, the study considered some important and recognized factors in IS research that proposed to affect the IS impacts from user perspective external factors that affect the core constructs of TAM and TTF.

We notice that some studies examined the introduction of new IS or systems development applications. However, prior studies have used the previous models to test some specific relationships or to achieve some specific aims as mentioned previously. They have employed these models with a very tight view to meet new requirements or research purposes. This encourages conducting more empirical research to obtain more accurate results about the relationship of IS impacts and user aspects.

On the other hand, as one of our objectives is to identify the most important factors that affect user performance directly and indirectly within IS environment. These factors are listed in table (1) below:

TABLE I
FACTORS INVESTIGATED IN PREVIOUS RESEARCH

<p>1- System quality: Response/turnaround time Accessibility Flexibility of systems Integration of systems Error recovery Security of data Reliability Correctness System ease of use system usefulness</p>	<p>3- Technology factors: Task technology fit Locatability Compatibility Meaning Software Adequacy IS support IS training IS staff support and assistance</p>
<p>2- Information quality : Accuracy Timeliness Precision Information volume Formatting Reliability Currency Completeness Relevancy</p>	<p>4-User Characteristics: Experience Position User type and usage Education Gender Age</p>
	<p>5-Evaluative Factors : System use Usage behaviour Attitudes to use IS User satisfaction</p>

VI. SUMMARY AND FURTHER DIRECTIONS

A noticeable amount of research has been written about information systems and end user productivity and performance during the last decades ([48], [46], [42], [116], [21], [112]). At the best, the results of these studies are mixed and controversial.

The majority of these studies could be categorized as having a focus on user satisfaction, system use and performance or and productivity and also most of the measurement instruments that have been used in these studies were largely based on subjective self reporting. The dependent and independent factors varied based on the aims of the research [116], [112], [21]. However, the most common variables that have been investigated include: perceived usefulness, ease of use system

quality, information quality, user satisfaction, individual impact, and organizational impact.

Moreover, many of these studies have mentioned or called for the need to concentrate on the quality of the applications [21]. They suggested that researchers should combine end user computing and application utilization measures to assess applications and the benefits or impacts on end user performance [32].

Finally a common point has been concluded in most previous studies that the need for reliable measure, conceptual framework to investigate the impacts of IS on performance still existed in IS literature and theory. And also the lack of comprehensive review pressures both practitioners and academics to conduct more research in the field.

Thus, further investigation about these factors and the way they influence user performance is tremendously precious for both academics and organizations which might improve understanding about the user within organizations.

Further research should try to investigate in details these factors and examine in details user personality with other factors and how they affect performance. In addition, investigating user needs and expectations from particular applications may help to fix any gaps between task requirements, user needs, and systems impacts. In short, while some known about user and IS impacts on user performance, but much still unknown in this area, which needs more research efforts to explain many aspects in this field.

APPENDIX A

A SUMMARY OF SELECTED STUDIES IN IS AND USER PERFORMANCE AND THEIR FOCUS

Authors	Description of Study	Essential factors investigated in the study
[39]	User acceptance of computer technology: A comparison of two theoretical models.	User attitudes to apply new information system
[4]	User acceptance Technology, attitudes to use and system impact	PEU, PU, User attitudes, on the system use and individual impacts
[95]	TAM User acceptance new Technology	EU, PU, User attitudes, on the system use
[128]	System use, TAM and quality of outcomes	Job relevance, output quality , PEU, PU, Attention to use , usage
[41]	technology acceptance model for empirically testing new end user computing	User satisfaction , user attitudes and system use => individual impacts
[55]	Investigate TAM for work related task with WWW	EU, PU ,IQ => the work
[43]	user acceptance of information system	User satisfaction, system user usefulness and ease of use => individual impacts
[103]	User acceptance of IS , user perception	System features , PEU, PU, Attitudes => system use and impacts
[37]	IS and end user acceptance (ERP)	Motivational factor =>, Performance outcomes
[5]	TAM and ERP implication , success factors and performance impacts	PEU , PU , Attitudes and behaviour attention to use system => performance
[84]	examining the relationships between TAM and user	System use , user satisfaction => individual impacts
[127]	User acceptance (TAM)	PEU, EU, behaviour attention => usage behaviour
[126]	TAM , Gender and social influences on Usage	User acceptance, adoption experience, attention and social effects => usage behaviour
[59]	Perceived Service quality and user satisfaction with the information services function	System quality reliability and empathy => user satisfaction
[49]	individual differences and the acceptance of new IS	Individual characteristics , perception , new technology => individual impacts
[134]	User satisfaction and information systems	Attitudes , use and satisfaction = > user performance
[139]	An empirical assessment of a modified technology acceptance model.	User satisfaction , system use , usefulness and ease of use => evaluation impacts
[56]	Evaluate the impacts of information systems on organizations and managers.	User satisfaction, convenience of access, flexibility, integration of system, and Response time => managers and organization
[68]	IS and production managers	User satisfaction and use of use to support production => manager performance
[106]	Understanding the impacts of internet banking adoption and user behaviour.	Internet implementation => user behaviour and system use
[95]	Information system acceptance by individual professionals	IS use => individual performance
[62]	Information systems and system professionals	Direct use of IS vs. chauffeured user => IS professional usage
[17]	Decision support systems and teams, effects of teamwork and performance	Use vs. non-use of data sets => team performance
[29]	The relationship between system use and IS impacts	frequency of past use and frequency of intended use => system use
[90]	System use and performance	Frequency of general use and frequency of specific use => performance
[115]	Information systems success	User satisfaction and, usage, => performance impacts.

[122]	How IS change the task and affect motivation	IS usage => performed task
[85]	Evaluation of system effect, usefulness and user satisfaction	Personalization, structure, organization of information and navigation => Performance
[66]	End user computing acceptance	PEU, PU, training => system use
[101]	System development and managers performance	Extent of use => manager performance
[72]	System usability and design	Using web site, satisfaction impact => user performance
[104]	IS and firm's performance	Frequency of use and Regularity of use => performance.
[5]	TAM and ERP success factors implication	PEU, PU, Attitudes and behaviour attention to use system => performance
[74]	Investigating the use as an integral part of the user job	PEU, PU and system use => user performance
[7]	Computer – based modeling	Frequency of use, Time per computer session => outcomes effect
[10]	Usefulness, ease of use and how they affect user intention to use the new system	PEU, PU and system use TAM model
[92]	Usefulness and ease of use and the usage of IS	Systems use and usefulness => user behaviour
[44]	Measuring the user satisfaction about the IS	Database, computer systems, and programs => user satisfaction
[65]	Computer and technology impacts on the work	Satisfaction, system application and system use => worker performance.
[60]	Empirical test of the D&M of IS success	User satisfaction and system use => individual impact
[28]	Evaluating user interactions with clinical information systems:	User characteristics and expectations => satisfactions
[13]	The relationships between changes caused by the systems to users' work and the users' attitudes.	User information satisfaction System use, realization of expectations, => user work.
[105]	Emergency management DSS and management performance	Reliability, response time, ease of use and Ease of learning => management performance.
[50]	Response time, on-line system, background Activity, batch Processing	Response time and its effects on the job
[25]	Information systems and managers performance	Perceived usefulness of information systems by managers => manager performance
[87]	The impacts of DSS on marketers performance	Usefulness of DSS features => performance
[107]	Electronic information exchanges system and user behaviors.	Usefulness of specific functions behaviour, interface design, message systems => users
[7]	Computer – based modeling	Frequency of use, Response time, System reliability => System accessibility and number of reports generated
[13]	Information system and Decision making in organizations,	IS => User performance, Decision quality and time taken
[15]	Effects of IS on the user expectations and perception	User perception, expectation with the IS => performance
[69]	Performance ratings and importance of performance measures for IS staff and users	Information systems (IS) users and evaluation of IS staff performance
[95]	Investigating healthcare professionals' decisions to accept telemedicine technology	IS => Decision maker performance, and system use
[2]	Data integrity, system reports and how they affect managers	Computer systems => Managers productivity
[53]	Evaluating IS effectiveness on the organizations	Information systems => production Performance
[9]	Effects of computer-based clinical decision support systems on clinician performance	IS => Individual performance
[138]	PU of computer based information on the managers	Usefulness of the system => impacts on the managers.
[100]	Computerization, and productivity	Hardware and Software => workers attitudes and productivity
[63]	Computers and organizations	The effects of computing on the quality of jobs => decision making,
[33]	TTF effects, and task on individual performance	TTF, technology, task, characteristics => individual performance
[11]	PU & PUOS impacts productivity, and performance	Usefulness and ease of use => performance and productivity
[56]	Information systems, organizations and managers	User satisfaction, accessibility, flexibility, Integration and response time => individual and organization impacts
[31]	Validity and reliability information system success and user impacts	System use task and technology => User performance

[118]	expanded instrument for evaluating information system success	Effectiveness, information systems, success, => user information satisfaction
[111]	Information Systems Success	Usefulness, systems use, user satisfaction, system quality, information quality) => individual impacts
[84]	Validity and instrument IS	PU, Systems Use, SQ and IQ) => user evaluation
[35]	Validity and measurement	User satisfaction, system quality, information quality => user evaluation
[135]	Updated DeLone and McLean IS Success Model and validity, user satisfaction	User satisfaction, system quality, information quality => user acceptance

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Vitae

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