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Internet usage, user satisfaction, task-technology fit, and performance impact among public sector employees in Yemen

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Abstract

Purpose – The internet technology becomes an essential tool for individuals, organizations, and nations for growth and prosperity. The purpose of this paper is to integrate the DeLone and McLean IS success model with task-technology fit (TTF) to explain the performance impact of Yemeni Government employees.
Design/methodology/approach – Questionnaire survey method was used to collect primary data from 530 internet users among employees within all 30 government ministries-institutions in Yemen. The four constructs in the proposed model were measured using existing scales. The data analysis starts with initial exploratory factor analysis, then confirmatory factor analysis and lastly structural equation modeling via AMOS.
Findings – The results showed that the proposed integrated model fits the data well. Findings of the multivariate analysis demonstrate four main results. First, actual usage has a strong positive impact on user satisfaction, TTF, and performance impact. Second, user satisfaction has a great influence on performance impact. Third, TTF has a strong positive impact on user satisfaction and performance impact. Fourth, both user satisfaction and TTF mediate the relationship between the actual usage and performance impact.
Research limitations/implications – The public sector in Yemen contains three parts: Yemeni prime minister, Yemeni ministries, and government agencies. This study focuses only on the Yemeni employees among Yemeni ministries; hence the results are not necessarily generalizable. Moreover, there are biases when the researcher measures the actual Internet usage variable through asking a participant about their opinion regarding their usage because these are generally found to differ from the true score of system usage.
Practical implications – The findings should be very useful for the Yemeni Government in presenting the importance of information technology effects on individual efficiency and effectiveness. Therefore, the information from these findings should encourage and support the formation of future policy at the organizational level and national level. If the government utilizes these findings by setting up strategies to promote internet usage, this may, in turn, improve professional practice, personal development, and quality of working life.
Originality/value – This paper adds to the existing literature of information systems by combining actual technology usage, user satisfaction, and TTF to predict performance impact within the organizations. Furthermore, this study proposed a second-order model of performance impact in order to increase the power of explaining the output by the model, which contains four first-order constructs: process, knowledge acquisition, communication quality, and decision quality. The predictive power of the proposed model has a higher ability to explain and predict performance impact compared to those obtained from some of the previous studies.

Keywords User satisfaction, Internet usage, Performance impact, Yemen, DeLone and McLean, TTF
Paper type Research paper

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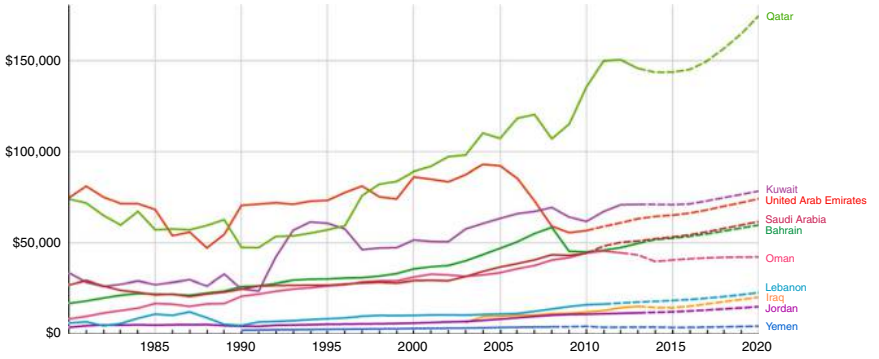
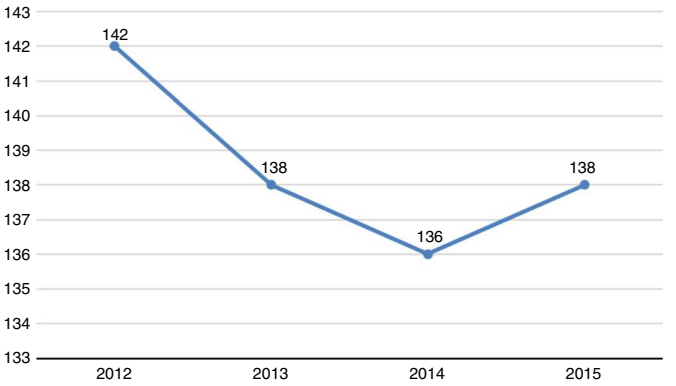
1. Introduction

Although Yemen faces economic challenges (see Figure 1) and efficiency shortfalls in its government institutions (see Figure 2), internet technology has the potential to improve all aspects of economic, social, cultural life, and play a major role in enhancing organizational



Source: International Monetary Fund (2015)

Figure 1. GDP per capita (Yemen vs Arab countries)



Sources: Global Information Technology Reports (2012, 2013, 2014, 2015)

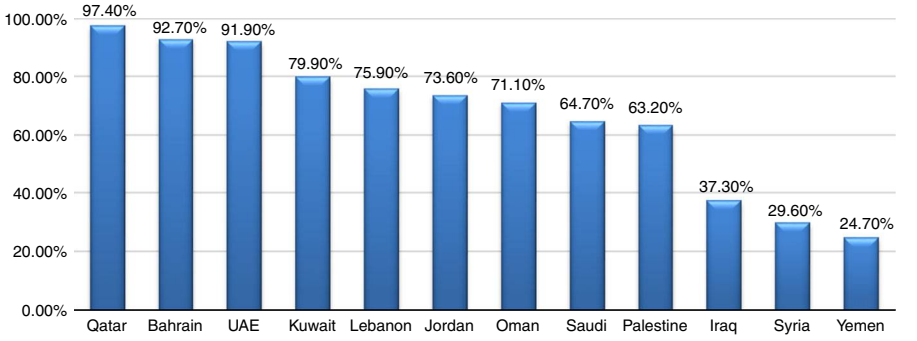
Figure 2. Ranking of Yemen in ICT use and government efficiency (out of 144 countries)

performance (Wang and Hou, 2003; Hou, 2004; Chen, 2008). The positive relationship between technology usage and the individual development of skills, knowledge, and productivity has been confirmed by previous studies (Delone and Mclean, 1992, 2003; Norzaidi *et al.*, 2007; Simsim, 2011; Glood *et al.*, 2016).

The internet has become an essential part of our daily life, enabling us to broadcast our thoughts, words, pictures, ideas, and experiences around the planet ever faster and cheaper. Its rapid spread has already connected around 40 percent of the world population currently estimated at 3,424,971,237 compared to 14,161,570 in 1993 (Internet Live Stats, 2016). However, despite the importance of the internet and its rapid expansion globally, Yemen has one of the lowest internet usage rates among the world's countries, unlike most of its neighboring Arab countries such as Qatar (97.40 percent), Bahrain (92.70 percent), UAE (91.90 percent), Kuwait (79.90 percent), Lebanon 75.90 percent), Jordan (73.60 percent), Oman (71.10 percent), Saudi Arabia (64.70 percent), and even Palestine (63.20 percent) which are doing well in internet penetration. At 24.70 percent (see Figure 1), Yemen has very poor internet penetration, while the world average is 46.4 percent (Internet World Stats, 2016). The country's total population is 27,477,600 million, with only 6,773,228 internet users. According to Delone and Mclean (1992, 2003), Goodhue and Thompson (1995), Norzaidi and Salwani (2009), and Makokha and Ochieng (2014), lack of technology usage leads to low performance and low productivity.

Yemen is significantly behind in adopting of one the greatest inventions of this generation (Hypponen, 2013). Moreover, low internet penetration problem hinders economic, social, and political development (Oyedemi, 2012). Studies have shown that internet usage is linked to national income (Pew Research Center, 2013); it positively influences organizational performance (Wang and Hou, 2003; Chen, 2008) and significantly impacts individual performance (Simsim, 2011). Consequently, internet technology usage can play a major role in encouraging economic growth in Yemen, improving government institution efficiency and enhancing employee performance (Figure 3).

Several well-known theories and models have been developed to investigate and understand technology usage and information systems (IS) which has reduced any ambiguity associated with IS and related issues, and include the following: technology acceptance model (TAM) (Davis, 1989), theory of reasoned action (TRA) (Ajzen and Fishbein, 1980), theory of planned behavior (TPB) (Ajzen, 1985), diffusion of innovation (DOI) theory (Rogers, 1995), model of PC utilization (MPCU) (Chang and Cheung, 2001), unified theory of acceptance and use of technology (UTAUT) (Venkatesh *et al.*, 2003). These theories and models only focus on usage behavior and adoption of information technology (IT), while disregarding its evaluation such as determining user satisfaction and performance impact (Shih and Chen, 2013) which is recommended as a measurement of IS success (Montesdioca and Maçada, 2014). Addressing these two aspects are the DeLone and McLean IS success model (DMISM) (Delone and McLean, 1992) and task-technology fit (TTF) (Goodhue and Thompson, 1995). While TTF focuses on the TTF construct and its relationship with performance impact and neglects user satisfaction, DMISM focuses on user satisfaction, actual usage, and performance impact constructs and ignores the TTF. This study has developed an integrated model to close the gap between TTF and DMISM (see Table I), examining the relationship between user satisfaction, actual usage, TTF, and performance impact among public sector employees in Yemen.



Source: Internet World Stats (2016)

Figure 3.
Internet usage as percentage of population (Yemen vs Arab countries)

Theory/model and source	Antecedent variable: Actual usage	Antecedent variable: User satisfaction	Antecedent variable: Task-technology fit	Output variable: Performance impact
Task-technology fit (TTF) (Goodhue and Thompson, 1995)	Gap	Gap	✓	✓
DeLone and McLean model of information systems success (DMISM) (Delone and Mclean, 1992, 2003)	✓	✓	Gap	✓
Proposed integrated model for closing the gaps	✓	✓	✓	✓

Table I.
Knowledge gaps and the proposed integrated model for closing the gaps

This study seeks to address the following research objectives: (1) To test and validate the proposed integrated model. (2) To examine the effect of actual usage of internet on user satisfaction. (3) To examine the effect of actual usage of internet on TTF. (4) To examine the effect of actual usage of internet on performance impact. (5) To examine the effect of user satisfaction on performance impact. (6) To examine the effect of TTF on user satisfaction. (7) To examine the effect of TTF on performance impact. (8) To determine whether the user satisfaction construct mediates the relationship between actual usage and performance impact. (9) To determine whether the TTF construct mediates the relationship between actual usage and performance impact. If the result of this study is that the main proposed variables have a significant impact on performance impact, the recommendations on how users could use the internet efficiently and effectively will be made. This research will also be a guide for research in other sectors, as long the study is concerned with internet technology.

2. Literature review

2.1 Actual usage

Actual usage is defined as the usage frequency of the technology and usage times (Kim *et al.*, 2007). Many studies in the context of IS measure actual usage through frequency of usage and duration of use (Sun and Mouakket, 2015; Mohammadi, 2015; Kim *et al.*, 2007; Chiu *et al.*, 2007; Porter and Donthu, 2006; Shih and Fang, 2004; Cheung *et al.*, 2000). The relationship between actual usage and performance is one of the most important directions for future research in the topic of technology usage (Venkatesh *et al.*, 2003), and few studies have contributed to fill the gap by addressing the link between actual usage and individual or organizational performance (Hou, 2012; Norzaidi *et al.*, 2007; Son *et al.*, 2012). There have, however, been a few studies on the influence of actual usage on performance impact. For instance, Norzaidi and Salwani (2009), in a quantitative study, found that the actual usage influences performance. And while several studies in the IS context have emphasized that actual usage positively influences performance (Isaac *et al.*, 2016; Makokha and Ochieng, 2014; D'Ambra *et al.*, 2013; Hou, 2012; D'Ambra and Wilson, 2011; Wang and Liao, 2008; Norzaidi *et al.*, 2007; Fan and Fang, 2006; Lee *et al.*, 2005), there are other studies which have found the opposite, that actual usage does not influence performance or net benefits (Cho *et al.*, 2015; Khayun and Ractham, 2011; Wu and Wang, 2006). There is a study showing that actual usage significantly impacts user satisfaction within the context of internet technology in Malaysia (Norzaidi and Salwani, 2009), and other studies found that actual usage predicts user satisfaction (Hou, 2012; Khayun and Ractham, 2011; Anandarajan *et al.*, 2002). The existence of a positive relationship between actual usage and TTF supported by several studies (D'Ambra *et al.*, 2013; D'Ambra and Wilson, 2011; Norzaidi and Salwani, 2009; Norzaidi *et al.*, 2007; Lee *et al.*, 2005). Consequently, the following hypotheses are proposed:

H1. Actual usage has a positive effect on user satisfaction.

H2. Actual usage has a positive effect on TTF.

H3. Actual usage has a positive effect on performance impact.

2.2 User satisfaction

User satisfaction is one of the essential factors which researchers need to take into consideration when studying technology usage (Delone and Mclean, 2003). Moreover, evaluating IT through user satisfaction is widely used to measure the success of IS (Montesdioca and Maçada, 2014). User satisfaction in this study is defined as the degree to which internet users satisfied with their decision to use the internet and how well it meets their expectations (Wang, 2008; Wang and Liao, 2008; Roca *et al.*, 2006). Notable studies have proven that user satisfaction influences performance impact (Fan and Fang, 2006;

Makokha and Ochieng, 2014; Norzaidi and Salwani, 2009; Son *et al.*, 2012; Wang and Liao, 2008). However, there are some studies which found that there is no relationship between user satisfaction and performance impact (Daud, 2008). Few researchers have studied the construct satisfaction as a mediator variable. Mosahab *et al.* (2010) examined the banking system in Iran, and Srivastava and Rai (2013) investigated the life insurance industry in India, both investigating the mediating effect of satisfaction in the relationship between quality and output loyalty, and found that satisfaction offers directional influence as a mediator of the relationship between quality and output loyalty. In another study, Ahmed *et al.* (2010) found that there is a mediation of satisfaction in the relationship between quality and behavioral intentions. However, as far as this study has been able to determine, no attention has been paid to examine the mediating role of user satisfaction between actual usage of technology and performance impact. Consequently, the following hypotheses are proposed:

H4. User satisfaction has a positive effect on performance impact.

H5. User satisfaction mediates the relationship between actual usage and performance impact.

2.3 TTF

TTF in this study is defined as the degree to which a system matches interests, fits (suits) with tasks, and meets the needs (Lin and Wang, 2012). Lu and Yang (2014) defined TTF as the degree to which a technology assists users in performing their work or coursework. It also appears to Lu and Yang (2014) as the degree to which a system is suitable for providing sufficient help to complete tasks and fit their requirements. In the context of technology usage in organizations, actual usage and user satisfaction are not enough to give a full picture without taking task characteristics into consideration, whether the technology fits with tasks or not (Goodhue and Thompson, 1995). TTF is considered highly imperative as far as studying technology usage in organizations is concerned (D'Ambra *et al.*, 2013). Several studies have been conducted to investigate the positive influence of TTF construct on IS success factors such as performance impact and user satisfaction (Glowalla and Sunyaev, 2014; Lee and Lehto, 2013; D'Ambra *et al.*, 2013; D'Ambra and Wilson, 2011; McGill and Klobas, 2009; Larsen *et al.*, 2009; Daud, 2008; Norzaidi *et al.*, 2007; Lee *et al.*, 2005), although few researchers have examined the TTF construct as a mediator variable. A study by Gatara and Cohen (2014) reveals that there is a mediating role of TTF between technology characteristics and performance. Gu and Wang (2009) found that TTF significantly mediates the relationship between individual quality and performance impact. This study contributes to the body of knowledge by investigating TTF as a mediator variable in the relationship between actual usage and performance impact. Consequently, the following hypotheses are proposed:

H6. TTF has a positive effect on user satisfaction.

H7. TTF has a positive effect on performance impact.

H8. TTF mediates the relationship between actual usage and performance impact.

2.4 Performance impact

Many of the previous studies regarding the usage and adoption of IT focus on actual usage as an output construct Cheng, 2014; Cheung *et al.*, 2000; Cheung and Vogel, 2013; Fatimah *et al.*, 2011; Fusilier and Durlabhji, 2005; Gao *et al.*, 2012; Hsu and Chiu, 2004; Im *et al.*, 2011; Iqbal and Qureshi, 2012; Joo and Sang, 2013; Lee *et al.*, 2011) and disregard the focus on evaluating IT usage such as performance impact (Shih and Chen, 2013) which is

recommended to measure the success of IS (Montesdioca and Maçada, 2014). Performance impact in this study is defined as the degree to which system usage affects job process, knowledge acquisition, communication quality, and decision quality (Princely, 2014; Khayun and Ractham, 2011). Norzaidi *et al.* (2007) defined performance impact as the degree to which system usage improves the quality of work, helps to accomplish the task quickly, allows control over work, improves job performance, eliminates errors, and enhances effectiveness on the job. Wu and Wang (2006) described it as the degree to which system usage improves communication quality and decision-making quality, leads to the acquisition of new knowledge and the generation of innovative ideas, enhances job efficiency and effectiveness, help in accomplishing tasks quickly, and improves quality of work life and job performance. Even earlier, Benedetto *et al.* (2003) reported performance impact to be the degree to which the system usage enhances effectiveness, improves efficiency, and increases productivity and problem identification. The measures of performance impact in the context of IS have been studied through different indicators (see Table II). Norzaidi *et al.* (2007) measured performance impact through the indicators of efficiency and effectiveness, while Hou (2012) measured it through individual productivity, decision-making speed, decision-making quality, problem identification speed, job effectiveness, job performance, and the extent of analysis in decision making. This study not only evaluates IT usage through performance impact construct as an output variable, but made a step forward to deal with it as a second-order model which contains four first-order constructs (job process, knowledge acquisition, communication quality, and decision quality). This study proposes the second-order model in order to increase the power of explaining the output of performance impact construct. By comparison, most previous studies have studied performance impact as one first-order construct with multiple items (Cheng, 2011; Hasim and Salman, 2010; Hou, 2012; McGill and Klobas, 2009; Norzaidi *et al.*, 2007).

3. Research method

3.1 Overview of the proposed research model

Organizations around the world are constantly looking for development opportunities, and keep up to date with any emerging technology which has the potential to improve performance. Theories and models in technology usage context abound, including TAM (Davis, 1989), DOI (Rogers, 1995), TRA (Ajzen and Fishbein, 1980), TPB (Ajzen, 1985), MPCU (Chang and Cheung, 2001), and UTAUT (Venkatesh *et al.*, 2003). Their research aimed to predict and explain user behavior but failed to focus on evaluating technology usage with its performance impact. Indeed, there is a lack of studies investigating output from technology usage (D'Ambra *et al.*, 2013), although in the context of IS, there are some notable researchers who do adopt models which investigate and evaluate output from technology usage through performance impact (Gatara and Cohen, 2014; Hou, 2012; Norzaidi and Salwani, 2009; Penna and Stara, 2008; Irick, 2008; Fan and Fang, 2006; Garrity *et al.*, 2005; Delone and Mclean, 2003), other studies still neglect to take into account the performance impact (Mohammadi, 2015; Lee and Lehto, 2013; Zhou, 2013; Revels *et al.*, 2010; Xu *et al.*, 2010; Liu *et al.*, 2008; Wu and Wang, 2006). This current study has developed an integrated model between DMISM and TTF as shown in Figure 4, as both of them include the performance impact in their models. DMISM focuses on actual usage and user satisfaction as the antecedent variables to performance, while the TTF focuses on TTF as an antecedent variable to performance. The proposed integrated model examines the relationship between internet usage, user satisfaction, TTF as antecedent variables and performance impact as an output variable among employees within the public sector in Yemen. The proposed model has eight hypotheses to test, six hypotheses which directly affect (*H1*, *H2*, *H3*, *H4*, *H6*, and *H7*) and two which have an indirect effect (*H5* and *H8*).

Table II.
Measures of performance impact in the context of IS among previous literature

Authors/year	Indicators									
	Accomplish tasks quickly	Accomplish tasks easily	Improve decision-making quality	Improve decision-making speed	Improve job efficiency	Improve job effectiveness	Improve communication quality	Acquire new knowledge	Acquire new skills	Acquire innovative ideas
Norzaidi *et al.* (2007)	✓				✓	✓				
Hou (2012)			✓	✓	✓	✓				
Norzaidi *et al.* (2009)	✓				✓	✓				
Wu and Wang (2006)	✓		✓		✓	✓	✓	✓		✓
D'Ambra *et al.* (2013)	✓				✓					
McGill and Klobas (2009)	✓	✓			✓	✓				
D'Ambra and Wilson (2011)	✓		✓		✓			✓		
Lee *et al.* (2005)					✓					
Princely (2014)	✓		✓		✓					
Hasim and Salman (2010)	✓				✓	✓				
Benedetto *et al.* (2003)					✓	✓				
Lwoga (2013)	✓				✓				✓	
Khayun and Ractham (2011)	✓				✓					
Cheng (2011)					✓	✓				

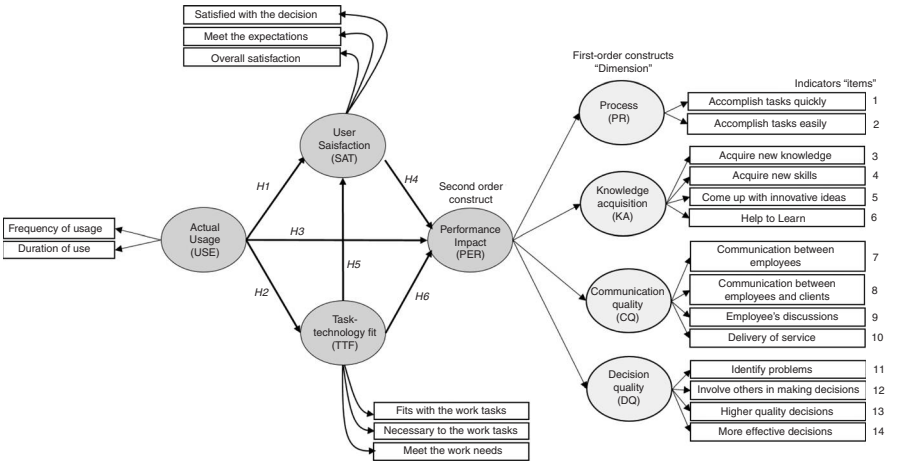


Figure 4.
The integrated research model

3.2 Development of instrument

A 22-item questionnaire was developed for this study, incorporating the four main constructs of the proposed conceptual model adopted from existing literature, and refined to fit with the context of this study. A pre-testing step was conducted before distributing the questionnaire instrument to a wider group. In total, 25 questionnaires were distributed to the university students from Yemen, who are presently studying in Malaysia. Their comments and recommendations were taken into consideration in order to fine-tune the questionnaire, particularly with regards to its length, the question sequence, and the resolution of any mistakes or confusing items. The final version was then pilot-tested to examine internal consistency, and out of the 60 surveys subsequently distributed among Yemeni employees in the Ministry of Communication and Information Technology, 58 were returned with complete and valid data. Beside the pilot test taking feedback comments into consideration, the validation of the measurement was done using Cronbach's α which measures the reliability (internal consistency) of the constructs. For the final questionnaire, all the constructs reliability had acceptable value, because the individual Cronbach's α coefficients exceeded the recommended value of 0.7 (Nunnally and Bernstein, 1994). This study used a seven-point Likert scale, ranging from 1 (strongly disagree) to 7 (strongly agree), to answer the questionnaire items. A Likert scale and other types of interval-type scales are extensively used in organizational research since they lend themselves to more sophisticated data analysis (Sekaran and Bougie, 2012). Please refer to Table AI for the instruments.

3.3 Data collection

The targeted population was approximately 6,090 of internet users among Yemeni employees in the head offices of all 30 government ministries (called Dwa'win) at the time this study was conducted. The adequate sample size for each ministry was selected based on the total number of employees, and the data were collected using a self-administered paper questionnaire, distributed personally to employees to motivate them and clarify any doubts. The main reason for choosing this method of delivery was that it provides a high predictive value for assessing the efficiency of participants, especially when the target subject under study is related to an individual's perception, belief, and opinion (Yalcinkaya, 2007).

A total of 700 questionnaires were distributed, and 530 sets were returned of which 508 responses were useful for analysis. The final sample size was considered adequate (Tabachnick and Fidell, 2012; Krejcie and Morgan, 1970). The response rate of this study is

76 percent, which is considered very good (Baruch and Holtom, 2008) by comparison with other studies found in the relevant literature. In total, 22 returned questionnaires were rejected, 12 because of missing data for more than 15 percent of the questions, four considered as outliers and six straight lining. The demographic profile of the respondents is shown in Table III. In total, 81.1 percent (412) were male and 18.9 percent (96) female. 1.4 percent were less than 20 years old, 28.3 percent between 20 and 29 years, 53.9 percent between 30 and 39, 12.6 percent between 40 and 49, and 3.7 percent were 50 years and above. In terms of education background, 10.4 percent had high school certificate, 8.7 percent had a diploma, 72.2 percent had a bachelor degree (the majority of participants), and the remaining 8.7 percent has finished postgraduate studies.

4. Data analysis and results

As this study proposed an integrated full model and a second-order model of performance impact which contains four first-order constructs (process, knowledge acquisition, communication

No.	Demographic item	Categories	Frequency	%
1.	Gender	1. Male	412	81.1
		2. Female	96	18.9
2.	Age	1. Less than 20 years	7	1.4
		2. 20-29 years	144	28.3
		3. 30-39 years	274	53.9
		4. 40-49 years	64	12.6
		5. 50 years and above	19	3.7
3.	Education background	1. High school	53	10.4
		2. Diploma	44	8.7
		3. Bachelor degree	367	72.2
		4. Master's degree	44	8.7
4.	Marital status	1. Single	117	23.0
		2. Married	380	74.8
		3. Divorced	9	1.8
		4. Widowed	2	0.4
5.	Department	1. IT department	181	35.6
		2. Not IT department	327	64.4
6.	Time in current position	1. Less than 1 year	29	5.7
		2. 1-3 years	74	14.6
		3. 3-5 years	90	17.7
		4. 5 years and above	315	62.0
7.	Income	1. Less than YER20,000	13	2.6
		2. YER20,000-YER39,000	59	11.6
		3. YER40,000-YER59,000	95	18.7
		4. YER60,000-YER79,000	86	16.9
		5. YER80,000-YER99,000	82	16.1
		6. YER100,000 and above	173	34.1
8.	Internet knowledge	1. Very poor	7	1.4
		2. Poor	22	4.3
		3. Moderate	153	30.1
		4. Good	211	41.5
		5. Very good	115	22.6
9.	Duration of internet usage	1. Less than 2 years	41	8.1
		2. 2-4 years	95	18.7
		3. 4-6 years	91	17.9
		4. 6-8 years	77	15.2
		5. 8 years and above	204	40.2

Table III.
Summary of demographic profile of respondents

quality, and decision quality), the analysis started with an exploratory factor analysis (EFA) to understand the structure of the variables and determine the correlation among them in the data set (Field, 2013), followed by a confirmatory factor analysis (CFA) to confirm the factor structure and specify how each construct is measured (Hair *et al.*, 2013). Structural equation modeling (SEM) via AMOS was then used to specify how the constructs were related to each other in the structural model.

There has long been a debate over the use and merits of EFA and CFA in organizational research, resulting in some extremely energetic exchanges on both the research methods and the SEM networks (Hurley *et al.*, 1997). According to Hair *et al.* (2013), the distinction between EFA and CFA is not always as clear-cut as it seems. CFA is used when testing the hypotheses of existing theories and concepts, and while EFA when searching in the data for latent patterns in case there is little or no prior knowledge about the factor structure and correlation (Hair *et al.*, 2013).

Although Brannick (1995) and Stone-Romero *et al.* (1995) have mentioned that the use of CFA is increasing while the use of EFA is declining, using EFA, CFA or both in the validation process is still legitimate. According to Cabrera-Nguyen (2010), distinguishing between CFA and EFA is becoming increasingly unclear. Brown (2006) suggests using "EFA in a CFA framework" as an intermediate step between EFA and CFA. Worthington and Whittaker (2006) advised to start with EFA and follow with CFA but use a different sample, while Green *et al.* (2016) recommended not to conduct EFA and CFA on the same data set. Kline (2005) mentioned that there is no need to use both techniques, use either EFA or CFA. And finally, according to Worthington and Whittaker (2006), using EFA followed by CFA is a common procedure for scale validation and development.

This study has followed the recommendation of Worthington and Whittaker (2006) and has carried out EFA by using a different sample size (192) followed by CFA and SEM (sample size 508) because there is a second-order model proposed in this research as a contribution, that needs to ensure the structure of the set of variables in the model, reduce a data set to a more manageable size, and ensure stability of the factor loading of various constructs. The same procedure, using EFA followed by CFA and SEM which the conceptual model include second-order construct has been performed in previous studies (Kafetzopoulos, 2015). The data analysis starts by conducting a descriptive analysis via SPSS 23 in the next section.

4.1 Descriptive analysis

Table IV presents the mean and standard deviation for each variable in the current study. Respondent were asked to indicate their opinion in the context of internet usage, measured on a seven-point scale ranging from 1 (strongly disagree) to 7 (strongly agree), only actual usage used five ranking scale. Communication quality recorded the highest mean score of 5.20 out of 7.0 points with a standard deviation of 1.506, indicating that the employees strongly agreed that using the internet helped in communication quality. Process, knowledge acquisition, and decision quality recorded the mean scores of 4.93, 4.41, and 4.59 out of 7.0 points with standard deviations of 1.572, 1.614, and 1.106, respectively, indicating that employees agreed that using the internet helped improve their task processing, knowledge acquisition, and the quality of their decisions. Moreover, the overall mean score for user satisfaction in the current study was 5.16 with a standard deviation of 1.228, indicating that the level of satisfaction among respondents regarding the decision to use the internet is high. Regarding the TTF, the result shows a mean score of 4.86 with a standard deviation of 1.485, indicating that the majority of employees agreed that the internet fits with their work tasks.

4.2 EFA

While there are two types of rotation to use in EFA (orthogonal and oblique), principal axis factoring was conducted on the 22 items with oblique rotation (Promax). Some scholars

Construct	Dimensions	Item	M for item	M for variable	SD for variable
PER	PR	PR1: accomplish tasks quickly	5.13	4.93	1.572
		PR2: accomplish tasks easily	4.73		
	KA	KA1: acquire new knowledge	4.62	4.41	1.614
		KA2: acquire new skills	4.33		
		KA3: come up with innovative ideas	4.27		
		KA4: help to learn	4.42		
	CQ	CQ1: communication between employees	5.40	5.20	1.506
		CQ2: communication between employees and clients	5.11		
		CQ3: employee's discussions	4.96		
		CQ4: delivery of service	5.32		
	DQ	DQ1: identify problems	4.42	4.59	1.106
		DQ2: involve others in making decisions	4.77		
		DQ3: higher quality decisions	4.49		
		DQ4: more effective decisions	4.67		
USE		USE1: frequency of usage	3.81	3.36	1.125
		USE2: duration of use	2.91		
SAT		SAT1: satisfied with the decision	5.06	5.16	1.228
		SAT2: meet the expectations	5.04		
		SAT3: overall satisfaction	5.38		
TTF		TTF1: fits with the work tasks	5.06	4.86	1.485
		TTF2: necessary to the work tasks	4.87		
		TTF3: meet the work needs	4.64		

Notes: USE, actual usage; SAT, user satisfaction; TTF, task-technology fit; PER, performance impact; PR, process; KA, knowledge acquisition; CQ, communication quality; DQ, decision quality. The measurement used is seven-point scale ranging from 1 (strongly disagree) to 7 (strongly agree), only actual usage used five-point ranging scale

Table IV.
Mean and standard deviation

argue that oblique rotation is always the appropriate method because: factor intercorrelations are the norm in social sciences, and if the factors happen to be uncorrelated both orthogonal and oblique yield the same result (Costello and Osborne, 2005). Regarding the significant factor loadings for each item, this study follows the criteria of Hair *et al.* (2010) based on the sample size. With 192 being the sample size for the EFA, the significant factor loadings are 0.40. This study used also a fixed number of factors to extract, the results regarding the statistical assumption for EFA as follows:

- the sample size is 192 which is enough to conduct EFA (Tabachnick and Fidell, 2012);
- Bartlett's test of sphericity is significant at ($p < 0.001$ (Field, 2013);
- Kaiser-Meyer-Olkin (KMO) value is 0.932 which is marvelous (Kaiser, 1974; Hutcheson and Sofroniou, 1999);
- communalities value for each item is > 0.5 (Field, 2013);
- total variance explained is 75.582 percent, which is > 50 percent (Podsakoff and Organ, 1986); and
- the variance for the first factor is 45.287 percent, which is < 50 percent (Podsakoff and Organ, 1986).

Pattern matrix in Table V shows the factor loadings after rotation. The items that cluster on the same components suggest that factor 1 represents a knowledge acquisition (explained 45.3 percent of the total variation), factor 2 decision quality (11.0 percent), factor 3 communication quality (6.3 percent), factor 4 TTF (5.6 percent), factor 5 user

	Factor						
	1	2	3	4	5	6	7
KA3	0.969						
KA2	0.954						
KA4	0.742						
KA1	0.680						
DQ4		0.890					
DQ1		0.865					
DQ2		0.854					
DQ3		0.842					
CQ3			0.897				
CQ2			0.824				
CQ1			0.818				
CQ4			0.793				
TTF3				0.923			
TTF1				0.873			
TTF2				0.864			
SAT1					0.922		
SAT3					0.829		
SAT2					0.812		
USE2						0.794	
USE1						0.755	
PR2							0.771
PR1							0.739

Notes: Extraction method: principal axis factoring; rotation method: Promax with Kaiser normalization; rotation converged in seven iterations; factor loading less than 0.4 suppressed

Table V.
Pattern matrix for the full model

satisfaction (3.2 percent), factor 6 actual usage (2.9 percent), and factor 7 process (1.3 percent). All factors explained 75.6 percent of the total variation. Of the 22 items, none were removed.

4.3 Measurement model assessment and CFA

4.3.1 Model fit indicators. Table VI shows the indicator of the goodness-of-fit indices for the measurement model together with the level of acceptance. In SEM, there are several fitness indexes that reflect how fit the model is to the data at hand. However, there is no agreement among scholars which fitness indexes to use and Hair *et al.* (2010) recommend the use of at least one fitness index from each category of model fit, of which there are three, namely parsimonious fit, incremental fit, and absolute fit. The absolute fit indices show that the χ^2 is not significant, but the model still fits because when large samples are used the χ^2 statistic nearly always rejects the model (Bentler and G.Bonnet, 1980; Jöreskog and Sörbom, 1993). The χ^2 is sensitive to sample size > 200 (Byrne, 2010), and the sample size for this study is 508. Model fit reported in RMSEA coefficient is 0.056, indicating a good fit. Other indicators are fit with GFI: 0.915 and AGFI: 0.891. In addition, incremental fit indices indicate that both tests are fit since the NFI and CFI obtained are 0.945 and 0.965, respectively. Finally, parsimony fit indices also indicate fit, since the PGFI is 0.719, and PNFI is 0.814, thus the model fits well. The result shows that the overall fit indices for the full model are acceptable, since absolute fit, incremental fit, and parsimony fit indices are fulfilled. Therefore, evaluation of the measurement model psychometric properties regarding construct reliability, indicator reliability, convergent validity, and discriminant validity could proceed.

4.3.2 Construct reliability. The individual Cronbach's α coefficients of the four main latent variables (ranging from 0.744 to 0.925) were higher than the recommended level of 0.7

Fit index	Cited	Admissibility	Result	Fit (yes/no)
χ^2			518.004	
df			199	
p value		> 0.05	0.000	No
χ^2/df	Kline (2010)	1.00-5.00	*2.60*	*Yes*
RMSEA	Steiger (1990)	< 0.08	*0.056*	*Yes*
SRMR	Hu and Bentler (1999)	< 0.08	0.049	Yes
GFI	Jöreskog and Sörbom (1993)	> 0.90	0.915	Yes
AGFI	Jöreskog and Sörbom (1993)	> 0.80	0.891	Yes
NFI	Bentler and G. Bonnet (1980)	> 0.80	0.945	Yes
PNFI	Bentler and G. Bonnet (1980)	> 0.05	0.814	Yes
IFI	Bollen (1990)	> 0.90	0.965	Yes
TLI	Tucker and Lewis (1973)	> 0.90	0.960	Yes
CFI	Byrne (2010)	> 0.90	*0.965*	*Yes*
PGFI	James *et al.* (1982)	> 0.50	0.719	Yes

Notes: df, degree of freedom; CFI, comparative-fit-index; RMSEA, root mean square error of approximation; SRMR, standardized root mean square residual; GFI, goodness-of-fit; NFI, normed fit index; AGFI, adjusted goodness-of-fit index; IFI, the increment fit index; TLI, Tucker-Lewis coefficient index; PNFI, parsimony normed fit index. The indexes in italic are recommended since they are frequently reported in literature (Awang, 2014)

Table VI.
Goodness-of-fit indices for the measurement model

(Kannana and Tan, 2005; Nunnally and Bernstein, 1994). Further, all the composite reliability (CR) values (ranging from 0.765 to 0.918) were above the recommended value of 0.7 (Hair *et al.*, 2010; Kline, 2010; Gefen *et al.*, 2000), indicating adequately that construct reliability is fulfilled. Therefore, the achieved Cronbach's α and CR for all constructs were considered as sufficiently error-free (see Table VII).

4.3.3 Indicator reliability. High loadings on a construct indicate that the associated indicators have much in common, which is captured by the construct (Hair *et al.*, 2013). Indicators with small loadings (below 0.40) have to be removed from the scale, while loadings ranging from 0.4 to 0.7 should be considered for elimination only when removing them leads to an improved value in CR or the average variance extracted (AVE) (Hair *et al.*, 2011). For all items in this study, the loadings exceeded the recommended value of 0.5 (Hair *et al.*, 2010). Since there is no loading below 0.70 (see Table VII) the items fulfilled the requirements without any elimination from the scale.

4.3.4 Convergent validity. Convergent validity is the extent to which a measure correlates positively with alternative measures of the same construct, and to establish convergent validity, researchers consider the AVE (Hair *et al.*, 2013). AVE with a value equal or higher than 0.50 indicates that, on average, the construct explains more than half of the variance of its indicators. On the contrary, AVE with a value less than 0.50 indicates that, on average, more error remains in the items than the variance explained by the construct (Hair *et al.*, 2013). For second-order constructs in the full model, assessing the validity of the set of sub-dimensions by AVE could be calculated by averaging the squared multiple correlations for the first-order indicators (Mackenzie *et al.*, 2011). Table VII shows the result of the convergent validity via AVE. The AVE values for performance impact (0.752), actual usage (0.622), user satisfaction (0.757), and TTF (0.789), indicate that all AVE values are higher than 0.50, which is acceptable. Convergent validity of the full model construct is fulfilled.

4.3.5 Discriminant validity. Discriminant validity is the extent to which a construct is truly distinct from other constructs by empirical standards, for establishing discriminant validity implies that a construct is unique and captures phenomena not represented by other constructs in the model (Hair *et al.*, 2013). By using the Fornell and Larcker's (1981) criterion, discriminant validity of the measurement model was checked. As shown in Table VIII, the

Construct	Item	Factor loading (above 0.5)	α (above 0.7)	CR (>0.7)	AVE (above 0.5)
PER	PER1: accomplish tasks quickly	0.89	0.925	0.833	0.752
	PER2: accomplish tasks easily	0.86			
	PER3: acquire new knowledge	0.87			
	PER4: acquire new skills	0.93			
	PER5: come up with innovative ideas	0.89			
	PER6: help to learn	0.82			
	PER7: communication between employees	0.85			
	PER8: communication between employees and clients	0.85			
	SPER9: employee's discussions	0.85			
	PER10: delivery of service	0.87			
	PER11: identify problems	0.90			
	PER12: involve others in making decisions	0.83			
	PER13: higher quality decisions	0.85			
	PER14: more effective decisions	0.87			
USE	USE1: frequency of usage	0.85	0.744	0.765	0.622
	USE2: duration of use	0.72			
SAT	SAT1: satisfied with the decision	0.87	0.903	0.903	0.757
	SAT2: meet the expectations	0.87			
	SAT3: overall satisfaction	*0.88*			
TTF	TTF1: fits with the work tasks	*0.91*	0.911	0.918	0.789
	TTF2: necessary to the work tasks	*0.90*			
	TTF3: meet the work needs	*0.85*			

Notes: CR, composite reliability; AVE, average variance extracted; AVE for the second-order model = averaging the squared multiple correlations for the first-order indicators; USE, actual usage; SAT: user satisfaction; TTF, task-technology fit; PER, performance impact. All the factor loadings of the individual items are statistically significant ($p < 0.01$)

Table VII. Loading, Cronbach's α, CR, and AVE for the full model

	Factors	1 TTF	2 SAT	3 USE	4 PER
1	TTF	*0.885*			
2	SAT	0.552	*0.870*		
3	USE	0.576	0.456	*0.788*	
4	PER	0.780	0.774	0.666	*0.867*

Notes: USE, actual usage; SAT, user satisfaction; TTF, task-technology fit; PER, performance impact. Diagonals represent the square root of the average variance extracted while the other entries represent the correlations

Table VIII. Results of discriminant validity by Fornell-Larcker criterion for the full model

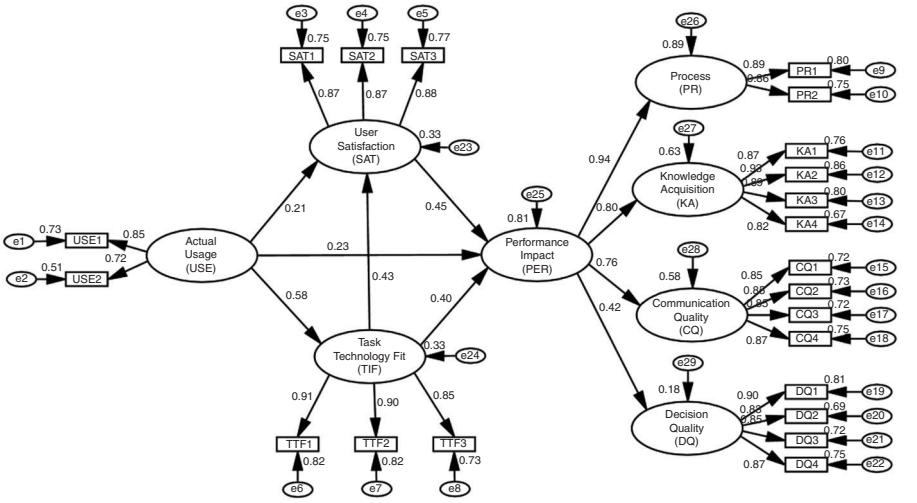
correlations between the four main constructs ranging from 0.456 to 0.780 are smaller than the square root of the AVE estimates which are in the range of 0.788-0.885. This indicates that the constructs are strongly related to their respective indicators compared to other constructs of the model, thus suggesting a good discriminant validity (Hair *et al.*, 2013). In addition, the correlation between exogenous constructs is less than 0.85 (Awang, 2014). Hence, the discriminant validity of the full model constructs is fulfilled.

4.4 Structural model assessment

The structural equation model is the second main process of SEM analysis. Once the measurement model is validated, representation of the structural model can be made by specifying the relationships among the constructs. According to Hair *et al.* (2010) and

Ho (2006), the structural model provides details on the links between the variables, showing the specific details of the relationship between exogenous variables and endogenous variables and specifying how the constructs are related to each other. Assessment of the structural model results enables the determination of how well empirical data support the theory and therefore to decide whether the theory has been empirically confirmed (Hair *et al.*, 2013). The goodness-of-fit of the structural model was comparable to the previous CFA measurement model. In this structural model, the $\chi^2/df = 2.603$, CFI = 0.965, and RMSEA = 0.056. These fit indices provided evidence of adequate fit between the hypothesized model and the observed data (Byrne, 2010). Figure 5 shows the research structural model results, as drawn on AMOS (version 21) graphics.

4.4.1 Hypotheses tests. The hypotheses of this study were tested using SEM as presented in Figure 5, and the structural model assessment shown in Table IX provides the indication of the hypotheses tests. The results for the six direct hypotheses of this study are supported. Actual usage significantly predicts user satisfaction, TTF and performance impact, hence, *H1*, *H2*, and *H3* are accepted ($\beta = 0.21$, $p < 0.001$), ($\beta = 0.58$, $p < 0.001$), and ($\beta = 0.23$, $p < 0.001$), respectively. User satisfaction, also significantly predicts performance impact, so *H4* is supported ($\beta = 0.45$, $p < 0.001$). Likewise, *H6* and *H7* are supported as TTF



Notes: $\chi^2 = 518.004$; df = 199; $p = 0.000$; relative $\chi^2 = 2.603$; CFI = 0.965; RMSEA = 0.056

Figure 5.
Research structural model results

Hypothesis	Dependent variables		Independent variables	Estimate β (path coefficient)	SE	CR (t-value)	Decision
H1	SAT	←	USE	0.21	0.065	3.426***	Supported
H2	TTF	←	USE	0.58	0.078	10.362***	Supported
H3	PER	←	USE	0.23	0.021	4.503***	Supported
H4	PER	←	SAT	0.45	0.024	7.289***	Supported
H5	SAT	←	TTF	0.43	0.043	7.674***	Supported
H6	PER	←	TTF	0.40	0.018	6.635***	Supported

Notes: USE, actual usage; SAT, user satisfaction; TTF, task-technology fit; PER, performance impact; CR, critical ratio. ***$p < 0.001$

Table IX.
Structural path analysis result

significantly predicts user satisfaction and performance impact ($\beta = 0.43$, $p < 0.05$) and ($\beta = 0.40$, $p < 0.05$), respectively. It is evident that user satisfaction has more influence on performance impact ($\beta = 0.45$) than on TTF ($\beta = 0.40$) and on actual usage ($\beta = 0.21$).

4.4.2 Coefficient of determination R^2: the variance explained. The R^2 value indicates the amount of variance in the dependent variables that are explained by the independent variables. Thus, a larger R^2 value increases the predictive ability of the structural model. The R^2 values should also be high enough for the model to achieve a minimum level of explanatory power (Urbach and Ahlemann, 2010). Falk and Miller (1992) recommend that R^2 values should be equal to or greater than 0.10 in order for the variance explained of a particular endogenous construct to be deemed adequate. Cohen (1988) suggest that R^2 is substantial when it is greater than 0.26 with acceptable power above 0.02, while according to Chin (1998), R^2 is substantial when it greater than 0.65 with acceptable power above 0.19. On the other hand, Hair *et al.* (2013) recommend that R^2 has to be larger than 0.75 in order to be deemed substantial with acceptable power above 0.25. Table X shows the result of R^2 from the structural model, indicating that actual usage, user satisfaction, and TTF are able to explain 81 percent of the variance in performance impact. Actual usage and TTF explain 33 percent of the variance in user satisfaction. Actual usage is able to explain 33 percent of the variance in TTF.

Table XI shows the results of R^2 and factor loading for the second-order model performance impact, which loads very well on three sub-constructs (process, knowledge acquisition, and communication quality), and load weak on decision quality. Further, the R^2 for the first three sub-constructs are substantial, while the sub-construct decision quality is weak.

4.4.3 Effect size f^2. Effect size f^2 measures if an independent latent variable has a substantial impact on a dependent latent variable (Gefen and Rigdon, 2011). According to Hair *et al.* (2013), in order to do an assessment for the R^2 values of all endogenous constructs, the change in R^2 value when a particular exogenous construct is omitted from the model can be used to assess whether the omitted construct has a substantial effect on the endogenous constructs. This measure is referred to as the f^2 effect size where "R^2 included" and "R^2 excluded" are the R^2 values of the endogenous construct when a selected exogenous construct is included in or excluded from the model. The change in R^2 values is calculated by estimating the path model twice. First with the exogenous construct included (yielding R^2 included) and second with the exogenous construct excluded (yielding R^2 excluded).

Exogenous construct	Endogenous construct	R^2	Cohen (1988)	Chin (1998)	Hair *et al.* (2013)
USE and TTF	SAT	0.33	Substantial	Moderate	Weak
USE	TTF	0.33	Substantial	Moderate	Weak
USE, SAT and TTF	PER	0.81	Substantial	Substantial	Substantial

Notes: USE, actual usage; SAT, user satisfaction; TTF, task-technology fit; PER, performance impact

Table X. Coefficient of determination result R^2

First-order constructs		Second-order constructs	Factor loading	R^2
PR	←	PER	0.94	0.88
KA	←	PER	0.79	0.62
CQ	←	PER	0.76	0.57
DQ	←	PER	0.42	0.18

Notes: PER, performance impact; PR, process; KA, knowledge acquisition; CQ, communication quality; DQ, decision quality

Table XI. R^2 and factor loading for the second-order performance impact model

f^2 is calculated using the given formula: $f^2 = (R^2$ included$-R^2$ excluded$)/(1-R^2$ included). According to Cohen (1988), f^2 of the exogenous latent variable is assessed as 0.02: small, 0.15: medium, and 0.35" large. Table XII shows the results of the effect size f^2 for the three exogenous latent variables (actual usage, user satisfaction, and TTF), which user satisfaction has large effect size, and actual usage has small effect size.

4.4.4 Mediation assessment. 4.4.4.1 Mediation effect of user satisfaction. Assessing the indirect relationships between latent variables is another important evaluation of a structural model (Henseler *et al.*, 2009). This section tests the mediation hypothesis (*H5*) as follows:

H5. User satisfaction mediates the relationship between actual usage and performance impact.

According to Field (2013), for this hypothesis to be true: actual usage must predict performance impact in the first place (path *c*); actual usage must predict user satisfaction (path *a*); user satisfaction must predict performance impact (path *b*); and the relationship between actual usage and performance impact should be smaller when user satisfaction is included in the model than when it is not. The direct effect of actual usage on performance impact, which is the relationship between them controlling for user satisfaction, can be distinguished from the indirect effect, which is the effect of actual usage on performance impact through user satisfaction.

Table XIII shows that the result of the direct path (*c*), the relationship between actual usage and performance impact is significant ($\beta = 0.40$, $p < 0.001$), suggesting that the direct effect condition is satisfied. Further, the path coefficients (*a*) in this model indicate that actual usage is positively linked to user satisfaction ($\beta = 0.46$, $p < 0.001$) and the path coefficients (*b*) indicate that user satisfaction is positively linked to performance impact ($\beta = 0.59$, $p < 0.001$). Finally, the findings show that the direct (*c*′) relationship between actual usage and performance impact ($\beta = 0.67$, $p < 0.001$), shrinks upon the addition of user satisfaction to the model, but is still significant, indicating that a mediation effect exists. While the path coefficient value decreased, the R^2 value on performance impact increased from 0.45 (or 45 percent) to 0.73 (or 73 percent) when user satisfaction is included in the model.

The second method to test the mediation effect is based on Preacher and Hayes (2004, 2008) whose method of bootstrapping the indirect effect was applied. Table XIV shows the result of the bootstrapping analysis which indicates that the indirect effect

Exogenous construct	Endogenous construct	R^2 included	R^2 excluded	f^2	Effect size
USE	PER	0.81	0.78	0.16	Medium
SAT	PER	0.81	0.68	0.68	Large
TTF	PER	0.81	0.73	0.42	Large

Table XII. Effect size f^2

Notes: USE, actual usage; SAT, user satisfaction; TTF, task-technology fit; PER, performance impact. $f^2 =$ (R^2 included$-R^2$ excluded$)/(1-R^2$ included)

				Estimate *b* (path coefficient)	SE	CR (*t*-value)	Result
Path *c*	PER	←	USE	0.40	0.028	6.191***	Significant
Path *a*	SAT	←	USE	0.46	0.061	8.259***	Significant
Path *b*	PER	←	SAT	0.59	0.030	7.874***	Significant
Path *c*′	PER	←	USE	0.67	0.039	7.008***	Significant

Table XIII. Mediation effect of user satisfaction

Notes: USE, actual usage; SAT, user satisfaction; PER, performance impact; CR, critical ratio. ***$p < 0.001$

$\beta = 0.41$ was significant with a t-value of 10.51. Further, Preacher and Hayes (2008) indicate that the 0.41, 95 percent boot CI: (LL = 0.116, UL = 0.269) does not straddle a 0 in between indicating there is mediation. Thus, this study can conclude that the mediation effect of the user satisfaction variable is statistically significant, also supporting *H5*.

4.4.4.2 Mediation effect of TTF. Table XV shows the result of the direct path (*c*) where the relationship between actual usage and performance impact is significant ($\beta = 0.33$, $p < 0.001$), suggesting that the direct effect condition is satisfied. Further, the path coefficients (*a*) in this model indicate that actual usage is positively linked to TTF ($\beta = 0.58$, $p < 0.001$), while the path coefficients (*b*) indicate that TTF is positively linked to performance impact ($\beta = 0.59$, $p < 0.001$). Finally, the findings show the direct (c') relationship between actual usage and performance impact ($\beta = 0.67$, $p < 0.001$), shrinks upon the addition of TTF to the model but is still significant, indicating that a mediation effect exists. While the path coefficient value decreased, the R^2 value on performance impact increased from 0.45 (or 45 percent) to 0.68 (or 68 percent) when TTF is included in the model.

The second method to test the mediation effect is based on Preacher and Hayes (2004, 2008) whose method of bootstrapping the indirect effect was applied. Table XVI shows the result of the bootstrapping analysis which indicates that the indirect effect $\beta = 0.47$ was significant with a t-value of 13.06. Further, Preacher and Hayes (2008) indicated that the 0.47, 95 percent boot CI: (LL = 0.120, UL = 0.265) does not straddle a 0 in between indicating there is mediation. Thus, this study can conclude that the mediation effect of TTF variable is statistically significant, indicating that *H8* was also supported.

5. Discussion and implications

5.1 Discussion

This study developed an integrated model between DMISM and TTF to examine the relationship between internet usage, user satisfaction, TTF, and performance impact among

Hypothesis	Relationship	Std β	SE	t-value	Decision
H5	USE→SAT→PER	0.41	0.039	10.51**	Supported

Notes: USE, actual usage; SAT, user satisfaction; PER, performance impact. **$p < 0.01$
Sources: Preacher and Hayes (2004, 2008)

Table XIV. Bootstrapping the indirect effect of user satisfaction

				Estimate *b* (path coefficient)	SE	CR (t-value)	Result
Path *c*	PER	←	USE	0.33	0.026	5.073***	Significant
Path *a*	TTF	←	USE	0.58	0.078	10.363***	Significant
Path *b*	PER	←	TTF	0.59	0.023	7.229***	Significant
Path *c'*	PER	←	USE	0.67	0.039	7.008***	Significant

Notes: USE, actual usage; TTF, task-technology fit; PER, performance impact; CR, critical ratio. ***$p < 0.001$

Table XV. Mediation effect of task-technology fit

Hypothesis	Relationship	Std β	SE	t-value	Decision
H8	USE→TTF→PER	0.47	0.036	13.06**	Supported

Notes: USE, actual usage; TTF, Task-technology fit; PER, performance impact. **$p < 0.01$
Sources: Preacher and Hayes (2004, 2008)

Table XVI. Bootstrapping the indirect effect of task-technology fit

public sector employees in Yemen. The present study provides a good explanation for a significant amount of variance (81 percent) in performance impact. The following discusses findings of this study based on its nine main objectives:

Findings relating to objective 1: the first objective of this study was to test and validate the proposed integrated model. The results show that the data fit the proposed integrated model, which contains four core constructs (actual usage, user satisfaction, TTF, and performance impact) well. Several studies have proposed various different indicators to investigate and measure performance impact in the context of IS (Cheng, 2011; Hasim and Salman, 2010; Hou, 2012; McGill and Klobas, 2009; Norzaidi *et al.*, 2007). In order to increase the power of explaining the output by the model, this study contributes to the body of knowledge by validating the performance impact construct as a second-order model which contains four first-order constructs (process, knowledge acquisition, communication quality, and decision quality), and 14 indicators (accomplish tasks quickly, accomplish tasks easily, acquire new knowledge, acquire new skills, come up with innovative ideas, help to learn, enhance communication between employees, improve communication between employees and clients, encourage employee discussions, improve delivery of service, identify problems, involve others in making decisions, higher quality decisions, and more effective decisions). The results show that employees strongly agreed that using the internet helps: improve their task process (accomplish tasks quickly and accomplish tasks easily), knowledge acquisition (acquire new knowledge and skills, come up with innovative ideas, and help to learn), enhance communication quality (communication between employees, communication between employees and clients, employee discussions and delivery of service), while moderately agreeing that the internet helped to improve decision quality (identify problems, involve others in making decisions, and making higher quality decisions). The findings should be very useful, not only to motivate non-users to use the internet for job-related work, but also useful for the top management in government institutions to be aware and recognize the importance of the internet. If the government can utilize these findings by setting up strategies to promote internet usage for non-users, this may, in turn, improve individual efficiency and effectiveness.

Findings related to objective 2: the second objective of this study was to examine the effect of actual usage on user satisfaction, and was achieved through testing hypothesis *H1*. This current study found that actual usage does have a positive effect on user satisfaction. This finding is consistent with previous studies (Norzaidi and Salwani, 2009; Hou, 2012; Khayun and Ractham, 2011; Anandarajan *et al.*, 2002), and explained by the fact that when actual usage of the internet increases among employees within government institutions, this leads to increase in employee satisfaction.

Findings related to objective 3: the third objective of this study was to examine the effect of actual usage on TTF, and achieved through testing hypothesis *H2*. This study found that actual usage does have a positive effect on TTF. This positive relationship is supported by several previous studies (Norzaidi and Salwani, 2009; D'Ambra *et al.*, 2013; D'Ambra and Wilson, 2011; Norzaidi *et al.*, 2007; Lee *et al.*, 2005). The result suggests that prior actual usage of the internet (frequency of usage and duration of use) by employees in government institutions increases their necessity to use the internet to achieve the work tasks and makes the internet fits with their work tasks.

Findings related to objective 4: the fourth objective of this study was to examine the effect of actual usage on performance impact, and was achieved through testing hypothesis *H3*. This current study found that actual usage does have a positive effect on performance impact, and this is supported by previous studies (Wang and Liao, 2008; Hou, 2012; Fan and Fang, 2006; Makokha and Ochieng, 2014; D'Ambra *et al.*, 2013; D'Ambra and Wilson, 2011; Norzaidi *et al.*, 2007; Lee *et al.*, 2005). It is also explained by the fact that when employees in government institutions increase their frequency and duration of internet usage, this leads

to an improvement in their performance in three dimensions: task process (accomplish tasks quickly and accomplish tasks easily), knowledge acquisition (acquire new knowledge and skills, come up with innovative ideas, help to learn), and communication quality (communication between employees, communication between employees and clients, employee discussions and delivery of service), while moderately increasing the fourth dimension which is improve decision quality (identify problems, involve others in making decisions, and make higher quality decisions). Although, many studies support the positive effect of actual usage on performance impact, Wu and Wang (2006) found the opposite, noting the absence of actual usage influence on perceived benefit. Khayun and Ractham (2011) also found that there is no relationship between actual usage and performance impact, while Cho *et al.* (2015) indicated that overall actual usage does not predicts the performance impact. The contradictory findings suggest that the effect of actual usage on performance impact may be different not only across the study settings but also across the variables which consider the components of actual usage and their measurements.

Findings related to objective 5: the fifth objective of this study was to examine the effect of user satisfaction on performance impact, and was achieved through testing hypothesis *H4*. This current study found that user satisfaction does have a positive effect on performance impact, corroborating the results of previous studies (Fan and Fang, 2006; Makokha and Ochieng, 2014; Norzaidi and Salwani, 2009; Son *et al.*, 2012; Wang and Liao, 2008). The result suggests that prior user satisfaction in the context of internet technology usage by employees among government institutions, improves their performance in three dimensions: task process (accomplish tasks quickly and accomplish tasks easily), knowledge acquisition (acquire new knowledge and skills, come up with innovative ideas, help to learn), communication quality (communication between employees communication between employees and clients, employee's discussions and delivery of service), and increase moderately the fourth dimensions which is to improve decision quality (identify problems, involve others in making decisions and higher quality decisions). However, the result of this study which relates to the positive effect of user satisfaction on performance impact inconsistent and conflicting with the result of Daud (2008) who found that user satisfaction does not affect performance impact.

Findings related to objective 6: the sixth objective of this study is to examine the effect of TTF on user satisfaction. This objective achieved through testing the sixth hypothesis (*H6*). This current study found that the TTF has a positive influence on user satisfaction. It can be argued that the more the employees find the internet fits with the work tasks, the more will be satisfied regarding the internet technology use.

Findings related to objective 7: the seventh objective of this study is to examine the effect of TTF on performance impact. This objective achieved through testing the seventh hypothesis (*H7*). This current study found that the TTF has positive effect on performance impact, which is compatible with previous studies results (D'Ambra *et al.*, 2013; D'Ambra and Wilson, 2011; Daud, 2008; Glowalla and Sunyaev, 2014; Larsen *et al.*, 2009; Lee and Lehto, 2013; Lee *et al.*, 2005; McGill and Klobas, 2009; Norzaidi *et al.*, 2007). The result indicates that prior that internet fits with the work tasks of employees lead to increase their performance in three dimensions: improve their task process (accomplish tasks quickly and accomplish tasks easily), knowledge acquisition (acquire new knowledge and skills, come up with innovative ideas, and help to learn), and communication quality (communication between employees, communication between employees and clients, and employee discussions and delivery of service), while moderately increasing the fourth dimension which is to improve decision quality (identify problems, involve others in making decisions and make higher quality decisions).

Findings related to objective 8: the eighth objective of this study was to determine whether the user satisfaction construct mediates the relationship between actual usage and

performance impact, and was achieved through testing hypothesis *H5*. This finding is consistent to a certain degree with a study by Srivastava and Rai (2013) which reveals the mediating role of satisfaction between quality and output loyalty. In addition to its direct effect, actual usage has an indirect effect via user satisfaction. Simply put, just being able to use the internet may compel employees to perform better without necessarily reflecting on their satisfaction.

Findings related to objective 9: the ninth objective of this study was to determine whether the construct TTF mediates the relationship between actual usage and performance impact, and was achieved through testing the hypothesis *H8*. This finding is consistent to some extent with a study by Gatara and Cohen (2014) which revealed the mediating role of TTF between technology characteristics and performance. Gu and Wang (2009) found that TTF significantly mediated the relationship between individual quality and performance impact. This finding highlights the importance of ensuring actual usage is associated with the output performance. In addition to its direct effect, actual usage has an indirect effect via TTF. This suggests that actual usage will still improve the performance of employees despite the absence of perception that internet services will fit their needs. In other words, just having the actual usage may compel employees to perform better, without necessarily reflecting on their needs. By contrast, Baas (2010) found that TTF did not have any meditation effect between employee satisfaction and output productivity.

5.2 Implications for research

This study has successfully integrated TTF and DMISM. The proposed conceptual model provides a fuller picture and a better understanding of the interplay between system usage and task characteristics, and demonstrates the role of prior actual usage, user satisfaction, and TTF, which are argued to have the capability to influence individual performance. The proposed integrated model is based on existing theories provides support for the TTF and DMISM. The findings of the present study can be added to the body of literature for the mentioned theories and model. Moreover, this study has proposed and validated a second-order model of performance impact in order to increase the power of explaining the output by the model, which contain four first-order constructs (process, knowledge acquisition, communication quality, and decision quality). Thus future research related to the context of IS can use the proposed second-order model to achieve better understanding of performance impact.

The variance explained by proposed model of the current study for output performance impact is 81 percent (refer to Table X). The predictive power of this model, which includes internet usage, user satisfaction, and TTF constructs, has a higher ability to explain and predict performance impact compared to those obtained from some of the previous studies, whose performance impact variance explained was 70 percent (Son *et al.*, 2012), 37 percent (Hou, 2012), 40 percent (Wang and Liao, 2008), 42 percent (Xinli, 2015), and 46 percent (Khayun and Ractham, 2011). This study shows evidence that the proposed model can be more effective for predicting performance impact especially within the internet context than other models in the previous literature.

Further, the TTF model has been useful in providing an additional explanation which the construct TTF is a strong predictor of employee's performance and it is a mediating variable between actual usage and performance impact. As such, it is affirmed that the prediction provided by the model is supported as evidenced by its ability to predict the relationships between the main constructs of the hypothesized model with regard to a technology usage, i.e. internet technology services.

5.3 Implication for practice

Yemen has a long-term strategy aimed at developing a reliable and efficient administration and government by improving and reforming its ministries and institutions to deliver better

public services for all its citizens and gain recognition around the world. However, not all the goals relating to governmental functions have been achieved. Problems still needing reforms include an inflated bureaucracy, a lack of collaboration between ministries and agencies, and a lack of direct vision for the future of the country. In its attempt to overcome these problems, the Government of Yemen has launched a reform project using IT to implement e-government, which will lead to a collaboration between governmental agencies and result in integrated databases that can be accessed by any agency any time, thus delivering rapid and efficient service to the public (Alsohybe, 2007). An understanding of the findings of this study will provide significant insights to policy makers and top managers with regard to identifying strategies that would improve the utilization of the internet within their organizations.

The implications of the key findings provide significant benefits, not only for individual employees, but also for the Yemeni public sector and the country as well if they can adopt IT and promote the use of the internet for job-related activities. Employees in this study generally agreed that using the internet helped improve their job processes, enhance their knowledge acquisition, raise the quality of their communication, and improve the quality of their decisions. The findings should be very useful for the Yemeni Government in highlighting the importance of the effect of IT on individual efficiency and effectiveness, therefore, encourage and support the formation of future policy at both organizational and national level. If the government can utilize these findings by setting up strategies to promote internet usage, then there will be improvement in professional practice, personal development, and quality of working life. This, in turn, will result in supporting government institutions to achieve goals of quality and cost-effectiveness, with an ultimate spread of these significant benefits to the country as a whole.

6. Limitations and suggestions for future work

The population of this study is the Yemeni employees in the three sections of the Yemeni public sector (prime minister's department, ministries, and government agencies). This study focused only on ministry employees. It should also be noted that Straub *et al.* (1995) mentioned that there are biases when the researcher uses self-reported measures of usage because these are generally found to differ from the true score of system usage.

This present study enriches the body of knowledge by developing an integrated model to better understand the internet technology usage among employees within the public sector. There are other areas that future researchers can explore from different perspectives, such as applying the proposed integrated model in the study to other task structures in similar sectors, or instead of measuring output based on the individual performance, future researchers could investigate output based on organizational performance. Researchers could also examine whether there is a moderating effect of demographic factors such as age, gender, experience, and income.

7. Conclusion

The main objective of this study was to investigate the relationship between internet usage, user satisfaction, TTF, and performance impact. The research proposed an integrated model between DMISM and TTF to better understand internet technology usage among employees within the public sector in Yemen. Further, the proposed integrated model provides a better theoretical foundation for future studies in technology adoption. As such, this work has added to the understanding of technology usage within theories of technology acceptance, IS success and TTF, and has proposed and validated a second-order model performance impact which contains four first-order constructs (process, knowledge acquisition, communication quality, and decision quality). The analysis examined the relationship between the variables of the proposed model, including an initial EFA, a CFA

and lastly a SEM via AMOS. The results from the descriptive analysis showed that employees strongly agreed that using the Internet helped improve: their task process, their knowledge acquisition and the quality of their communication, but only moderately agreed that internet helped to improve the quality of their decision making. The majority of employees were satisfied with the decision to use the internet and agreed that it fits with the work tasks. The study is justified, as it support what has been suggested in the literature on technology usage, the prior user satisfaction, actual usage, and TTF are critical for the comprehension of performance impact. The role of user satisfaction is the prime and vital mover in determining the variance of performance impact. Actual usage has a positive influence on user satisfaction and TTF, and TTF predicts user satisfaction. Further, this study found that both variables (user satisfaction and TTF) mediate the relationship between actual usage and performance impact. The implications of this present study from the perspective of academics and practitioners have been discussed, along with the limitations and some directions for future research.

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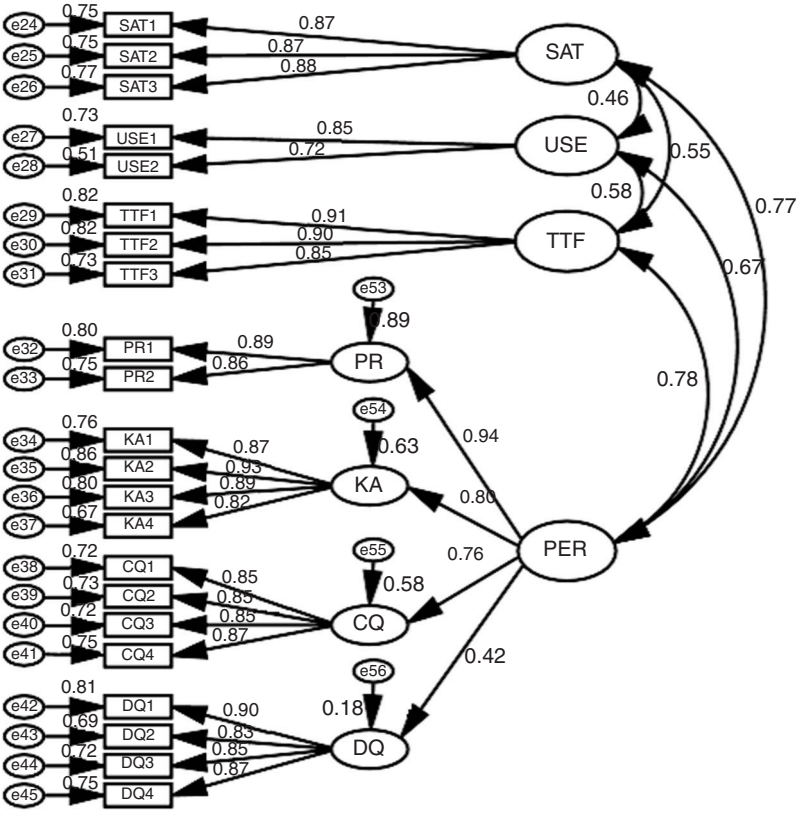
Appendix 1

Variables	Item and measure	Rating scale	Source
User satisfaction	(Satisfied with the decision): My decision to use the internet was a wise one (Meet the expectations): The Internet has met my expectations (Overall satisfaction): Overall, I am satisfied with the Internet	Seven-point Likert scale: (1) strongly disagree to (7) strongly agree	Wang and Liao (2008), Wang (2008), Roca *et al.* (2006)
Task-technology fit	(Fits with the work tasks): Internet services fit with the way I accomplish my work tasks (Necessary to the work tasks): Internet services are necessary to my work tasks (Meet the work needs): Internet services meet my work needs	Seven-point Likert scale: (1) strongly disagree to (7) strongly agree	Lee and Lehto (2013), Larsen *et al.* (2009), Lu and Yang (2014)
Actual usage	USE1 (Frequency): How often do you use the internet? Don't use ☐ Once each month ☐ Once each week ☐ once each day ☐ several times in day USE2 (Time): How often do you use the internet each time? ☐ Don't use ☐ less than 1 hour ☐ 1-2 hours ☐ 3-4 hours ☐ More than 5 hours	Five-point scale	From Shih and Fang (2004)
Performance impact	(Accomplish tasks quickly): Internet helps me to accomplish my tasks more quickly (Accomplish tasks easily): Using Internet make it easier to complete my tasks (Acquire new knowledge): Internet helps me acquire new knowledge (Acquire new skills): Internet helps me acquire new skills (Come up with innovative ideas): Internet helps me to come up with innovative ideas (Help to learn): Internet helps me to learn (Communication between employees): The use of internet improves communication between employees (Communication between employees and clients): The use of internet improves communication between the employees and the clients (Employee's discussions): The use of Internet improves employee's discussions (Delivery of service): The use of internet improves the delivery of service (Identify problems): Internet helps me identify problems (Involve others in making decisions): Internet helps me involve others in making decisions (Higher quality decisions): Internet helps me make higher quality decisions (More effective decisions): Internet helps me make more effective decisions	Seven-point Likert scale: (1) strongly disagree to (7) strongly agree	Hou (2012), Norzaidi *et al.* (2007, 2009), McGill and Klobas (2009), Princely (2014), Lwoga (2013)

Table AI.
Instrument for variables

Appendix 2



Notes: $\chi^2=512.004$; df=199; $p=0.000$; Relative $\chi^2=2.603$; CFI=0.965; RMSEA=0.056; GFI=0.915; AGFI=0.891; NFI=0.945; PNFI=0.814; IFI=0.965; TLI=0.960; PGFI=0.719

Figure A1.
CFA for the full model

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