Assessment of The Usability of Mobile Commerce Prototype From The Users Perspective

Saleh Alqatan, Mohammad H. Alshira’h

Abstract: Despite the M-commerce advantages for Small, Medium, and Micro-Sized Enterprises (SMMEs), especially in the tourism industry, these enterprises have limited access to information on technology adoption. This prevents them from understanding the implications of technology adoption, effective ways of managing competition, determining business and customer needs, and the ability to make strategic and sustainable decisions. This study aimed to develop a tentative design of Tourism M-commerce prototype (TMCP) based on the task-technology fit, perceived usefulness, perceived ease of use, task characteristics and technology characteristics, and to employ SUS and expert review in evaluating the TMCP for determining the factors influencing Mobile commerce. The questionnaire was distributed to the target sample and the obtained data from questionnaires was analyzed through the SPSS statistical software. On the basis of the prototype evaluation results, the proposed model is validated. In this case, the results of the evaluation provided insight into the effect that user acceptance factors have on the level of acceptance of M-commerce among Jordanian SMTEs. The validation also confirmed the relationship between acceptance factors and the acceptance of the M-commerce application among SMTEs. This study opens up opportunities for further studies to use user acceptance theories for system designs in other application domains.

Index Terms: Evaluation, Mobile commerce prototype, Perceived ease of use, Perceived usefulness, Small and Medium-sized Tourism Enterprises, Task characteristics, Technology characteristics , The task-technology fit

1 INTRODUCTION

In the previous decade, development in the tourism and hospitality sectors in light of Information and Communication Technology (ICT) usage has been hailed as one of the significant progresses that occurred. The services that are offered in the tourism sector heavily depend on tourists acquiring information and booking while being geographically distant from their place of visit [1]. It is a widely known fact that ICT offers great benefits for firms to enhance their operations in order to be more effective, efficient, and competitive [2]. Nevertheless, there were not many studies conducted on the ICT practices in the small and medium-sized enterprise (SME) sector, unlike the vast number of researches conducted on large firms [2, 3]. Although there are initiatives to employing ICT in developing countries (DC), a large number of businesses in those countries have very limited or no access to technological tools [4, 5]. In the context of developing nations, small and medium-sized tourism enterprises (SMTES) lack the required skills and resources for the development and maintenance of company websites, although they have increasingly progressive online presence [6]. Through the use of ICTs, tourists and enterprises can communicate effectively, and the enterprises’ resources and reservations can be managed better. Apart from that, leveraging on emerging technologies, like mobile commerce (M-commerce), may lead to the introduction of online commercial transactions as an option for SMTES. This allows for customers to interact with the companies in advance of their trip, while decreasing the SMTES’ risks [6, 7]. Smartphone and mobile apps enable users to scan product codes, confirm and compare prices and buy products online [8]. M-commerce originated from the evolution of the mobile devices usage (e.g., smartphones) [9, 10]. Following ICT, M-commerce has already begun to expand its reach in different sectors [11].

The strength of M-commerce lies in its mobility, where business transactions can be made using mobile devices [10, 12-15]. Mobile applications offer flexibility to users. For example, through mobile technology is now possible to transfer money or pay bills through a mobile device. In addition, similar services can consolidate their transactions into a single application, such as mobile banking and mobile ticketing. Many mobile applications are currently available, including mobile banking, mobile entertainment, mobile information services, mobile marketing, mobile shopping, telematics services, and mobile ticketing [16]. Each of these types is explain as follow: Mobile Banking: There are several options available to consumers for the transfer of money, such as for the purchase of goods or services. Transactions can be made through credit cards, direct mobile billing, and SMS payments. Mobile Entertainment: Mobile entertainment applications allow users to access entertainment, such as music and videos on their mobile devices, and also allows for social interactions with other users, such as chat rooms and online dating. Mobile Information Services: This includes applications that provide up to date information to users, including news, e-mails, travel information, etc. Mobile Marketing: This includes applications that allow companies to interact with customers to increase sales, improve service, conduct market research, or increase customer loyalty. The use of mobile marketing allows companies to market their products or services, while still being inexpensive. Mobile Shopping: Mobile shopping applications allow customers to purchase good through their mobile device. The products that are available for sale are mostly standardised products that are chosen from a mobile catalogue. Products do not have to be digital in nature. Mobile Ticketing: This application allows tickets that were purchased to be sent directly to the customer’s mobile device. Often this type of application is integrated to a company’s promotional or marketing side of the business. Telematics Services: This type of application allows a linkage between information technologies and telecommunication technologies, and is often used in transportation as the Intelligent Transport System (ITS).
This application can offer navigation services and diagnosis, and access to other types of mobile applications. M-commerce development and proliferation to various fields has been highlighted in studies [17] and it was brought about by the development in mobile applications. Moreover, M-commerce is more appropriate for developing nations with immobile and pricey desktops, and fixed-line infrastructure that is lacking in robustness [18]. In a related study, M-commerce development in the developing nations was evidenced as slow [19] and this urges authors to conduct studies in order to determine the reasons behind such slow development. Particularly, the Arab region is left behind when it comes to M-commerce adoption owing to several reasons [20, 21]. Users surf the net and listen to music through mobile devices and majority of them do not use them to purchase goods/services [22, 23]. Further studies are needed to understand reasons behind low adoption of E-commerce. In this regard, the present study attempts to research on barriers of M-commerce and minimize the gap in literature.

2 TECHNOLOGY ACCEPTANCE THEORIES/ MODELS
User acceptance is one of the significant factors of M-commerce development and success in SMTEs. Technology acceptance generally refers to the way people accept and adopt new technology [24]. IS theories and models are developed abundantly [25], as such models provide better insights on the factors influencing consumers’ adoption of technology. This makes the identification of factors that prevent or drive the adoption and acceptance of new technology a main objective of several studies that have examined user acceptance [26, 27]. Therefore, this study adopts a substantive theory to explain the behavioral intention of users in SMTEs in developing countries, with the main variables being intention to use and actual use [25, 28]. The theoretical model of user’s acceptance of IS is presented in Figure 1.

![Fig. 1. Theoretical model on user acceptance of information technology](image)

The IT use in predicting appropriate behavior may be invaluable in predicting actual use and ultimately, adoption of technology. Many models have been brought forward in order to determine the intentions and behavioral intentions towards use of technology. Under this section, the technology acceptance theories and models are presented and discussed, in particular the following theories:

I. Technology Acceptance Model (TAM).
II. Task-Technology Fit (TTF) Model.

These models and theories are developed in different contexts with the aim of providing a deeper understanding of user’s acceptance, adoption and use of new technologies. The following subsections provide a discussion of some of the models.

2.1 Technology Acceptance Model (TAM)
TAM refers to a model whose primary purpose is to predict the intention of the user to use specific technology [13]. In addition to this, TAM is the most extensively employed model for studying technology and E-commerce adoption in prior studies that focused on consumer’s behavior in online shopping [29]. TAM has been acknowledged in terms of its validity and reliability to shed light on technology acceptance and use, and examined in different situations and samples. TAM is highly dependent on other factors in determining behavioral intention (i.e., perceived ease of use and perceived usefulness) (refer to Table 1).

**Table 1 Definitions of the constructs in TAM [30]**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Describe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived usefulness</td>
<td>The level to which an individual is convinced that a specific system use would contribute to enhanced job performance.</td>
</tr>
<tr>
<td>Perceived ease of use</td>
<td>The level to which an individual is convinced that a specific system use would be effortless or effort-free.</td>
</tr>
<tr>
<td>Attitude toward using the system</td>
<td>The level of evaluative impact that an individual relates with the use of a specific system in his job tasks.</td>
</tr>
</tbody>
</table>

Studies in literature [31, 32], contended that additional factors or IT acceptance models should be integrated with TAM to enhance its function. Several studies have extended and modified TAM to explain acceptance of new technology. TAM is extensively used in studies because of its parsimonious, IT-centered design that clearly explains the prediction of various user populations’ acceptance of different IT tools in organizational contexts [33, 34]. SMMEs have to adopt M-commerce for their reconstruction. Therefore, TAM can identify potential factors to influence the reconstruction. Continues usage of the technology would enhance efficiency of SMMEs in the long-term [35]. It is important to determine relevant variables of TAM that are acknowledged by suppliers. This will highlight if the models fall short of providing M-commerce perspectives [36]

2.2 Task-Technology Fit (TTF) Model
The origin of the Task-Technology-Fit (TTF) model can be traced back to the Cognitive theory [37], based on the notion that the presence of a cognitive match between the problem solving aids/methods and the task can mitigate the complexity of the task and improve the method’s effectiveness. According to the TTF theory, a fit between task, technology and users positively impacts the acceptance and adoption of IT [38, 39]. It is a result of a combination of two research streams: the utilization focus and task-technology fit focus. The model comprises four main constructs: task characteristics, technology characteristics, task-technology fit and the outcome variable namely utilization. Contrary to the prior adoption theories, the TTF assumes that users will opt for a technology that is suitable to perform their tasks. The TTF also postulates that a new technology will be used if the functionality of such technology matches users’ activity [40, 41]. The basic TTF model is presented in Figure 2 as proposed by Strong, et al. [42].
The model applicability to a specific technology can be determined by examining the potential user’s tasks and conducting an analysis of the support of technology towards the tasks, following which a match between technology, tasks and the fit outcome (use) can be gauged [38]. The TTF model constructs along with their definitions are tabulated in Table 2.

**Table 2 Constructs of the TTF Model [38]**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Describe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task characteristics</td>
<td>Tasks are described as the individual’s actions involved in the transformation of inputs into outputs and they are characterized by factors that may motivate a user to be dependent on certain IT aspects.</td>
</tr>
<tr>
<td>Technology characteristics</td>
<td>Technologies are described as the level to which a technology assists in the performance of the individual’s task.</td>
</tr>
<tr>
<td>Task-Technology fit</td>
<td>Fit between task and technology refers to the level to which technology assists in the performance of the task.</td>
</tr>
<tr>
<td>Utilization</td>
<td>Utilization refers to the behavior of technology use in task performance.</td>
</tr>
<tr>
<td>Performance impact</td>
<td>Performance impact is linked to achieving the task portfolio of the individual.</td>
</tr>
</tbody>
</table>

More importantly, the validity of the TTF has been, time and again, evidenced by several authors [40, 43]. Studies integrated and tested TTF and process virtualization theory [44], in light of learning management systems evaluation [45], or by examining its role in boosting user’s ongoing use of the system [46]. It is important for mobile technologies to provide users with information whenever and wherever they require it [47]. In this regard, technologies are considered as tools employed to carry out tasks. [48] stated that in IS research, technology is described as mobile systems (hardware, software, and data) and user support services including training and helplines assist users to conduct their tasks. Tasks refer to the actions conducted by individuals in transforming inputs into outputs. [48] added that task characteristics should enable user to depend more on IS. Although the TTF model is not particularly designed for IS acceptance like E-commerce or M-commerce, it is still successful in its derivation of a new range of variables that could contribute to the understanding of the IS acceptance among consumers. The TTF model and its variables of task and technology characteristics have produced clear information on factors driving IS acceptance or the gaps in IS acceptance throughout countries [49]. Along a similar line of study, the factors that moderate the relationship of other factors have been considered in the Unified Theory of Acceptance and Use of Technology (UTAUT) [25] as well as in the model’s later version (UTAUT2) [50], when examining the IS acceptance were inconclusive and failed to differentiate consumers’ IS acceptance in E-commerce in different countries [49]. According to Kim, et al. [51], the task-technology fit has a positive relationship with perceived ease of use and perceived usefulness in the hotel IS case. The use of task-technology fit theory in mobile IS requires the consideration of the mobility of user [43]. Successful technology usage depends on the fit with the task that it is applied on and on a wireless environment, as this requires information concerning the location (Junglas et al., 2008). In this regard, the mobile devices’ geo-location abilities enable mobile shoppers to look for offers in their areas and save not only time but also effort indicating the match between technology and task [52]. User acceptance models should not only analyse factors influencing user acceptance, but should also provide guidance on how to design a specific application. Researchers are interested in explaining why a system is acceptable or unacceptable to a set of users, and also understanding how to design applications using user acceptance factors. Based on the literature review, many previous researches identified the role of M-commerce acceptance factors, but not how these factors can improve M-commerce applications. The use of acceptance models to guide system design and development has not been substantially explored [53, 54]. Several researchers [25, 50] pointed out that despite their predictive capability, user acceptance models provide support to guide design application and implementation, such as mobile banking applications [55] and electronic government systems [56]. Further studies are needed to examine the literature gap and mitigate it and thus, in the present study, the issue is addressed by determining the way user acceptance factors predict the design and development of M-commerce applications, specifically for SMTEs. Such a feat can make sure that M-commerce acceptance is accepted among SMTEs in the developing nation’s case. The study also attempts to conduct an evaluation of the tourism M-Commerce model effectiveness by examining a prototype developed for the same purpose.

3 Research Model

A proposed tourism M-commerce model was theoretically developed for the M-commerce applications acceptance on the basis of the TAM model and TTF model [57]. The model assists in understanding the factors contributing to obtaining users acceptance when it comes to using and adopting M-commerce applications among SMTEs. This primarily aims to enhance the adoption of M-commerce within such enterprises. The proposed tourism M-commerce model for tourism M-commerce is presented in Figure 3.
4 PROTOTYPING METHODOLOGY

Generally speaking, prototyping involves four major processes namely, designing, implementing, testing and operating. In the first phase, the prototype is drawn and given with a preliminary shape, size, color as well as other features and in the second phase, the prototype is developed from the materials that the design require. This is followed by the third phase, which involves testing the prototype to ensure its readiness and effectiveness for use. The final phase involves the operation of the prototype to test its operation effectiveness. In relation to the above, Bennett, et al. [58] brought forward a conceptual framework known as the system of lifecycle prototyping, wherein which the cycle has six phases (refer to Figure 4).

4.1 Initial Analysis

This step determines the prototype development requirements and the focus of the designers is laid on the objective of the prototype. The requirement for more research prompted this study to make use of explorative method for the determination of the drivers of successful prototype application creation on M-commerce for SMTEs and they include, perceived ease of use, perceived usefulness, task characteristics, technology characteristics and the task-technology fit.

4.2 Defining Prototype Objectives

The second phase involves the software development phase, also known as the requirement analysis phase, which is an activity characterized by the consumption of resources. In this phase, the user’s needs and requirements are determined. This is because prototype development based on ambiguous objectives will lead to misevaluation of processes, as a result of which difficulties will arise [58]. This study presents a prototype with the aim of highlighting the elements of the proposed tourism M-commerce model in its initial design in order to guide the development of an integrated system of M-commerce tourism that is applicable among SMTEs.

4.3 Specifying Prototype

Despite that fact that a prototype is only for temporary use, it is important to include the entire features in order to freely gauge required modifications later after the final product development. After the objective and the specifications of the prototype are established, it is further evaluated for the required modifications.

4.4 Constructing Prototype

Prototype construction is a crucial step that needs several discussion steps to be carried between the team members and
the users [59]. Prototypes are of two primary types namely, low-fidelity and high-fidelity prototypes. The low fidelity prototype is selected in this study owing to its low and reasonable cost and the capability of evaluating other alternatives to it. The prototype design was created based on the proposed tourism M-commerce model, indicating the significant effect of factors on the acceptance of tourism M-commerce applications. The prototype included all the factors to be evaluated and validated for user acceptance. Prior literature evidenced a significant relationship between user's acceptance factors and the features of the prototype and they validated the key role of the features as predictors of the perceptions and acceptance of users in various scenarios, situations and locations [53, 55, 56, 60, 61]. This stage calls for the user’s requirements as factors transformed into prototype features and developed according to Figure 5.

![Figure 5: User Acceptance Factors Reflected on Features in the Application Design](image)

**Table 3** Key Indicators for the User Acceptance in the Development of Preliminary Prototype of Tourism M-commerce

<table>
<thead>
<tr>
<th>Author(s) &amp; Year</th>
<th>IS Factor</th>
<th>Measurement Item</th>
</tr>
</thead>
</table>
| Bauerfeind, 2003; Baierova et al., 2003 | Perceived Usefulness (PU) | - Content Quality  
- Content Presentation  
- Layout |
| Hasan, 2014 | Perceived Ease of Use (PEOU) | - Quick Downloading of Web Pages  
- Easy Interaction with a Website |
| Wells et al., 2003; Shen and Chuang, 2010; Palmer, 2002; Zhang, 2001 | Perceived Task-Technology Fit (PTTF) | - Content  
- Interactivity |
| Fang et al., 2003; Adya and Lusk, 2012; Andreou et al., 2005; Chou, 2006 | Task Characteristics (Tas_C) | - Simple Task  
- Playfulness |
| Adya and Lusk, 2012; Fang et al., 2003 | Technology Characteristics (Tac_C) | - Integrated Product Or Service Information  
- Avatars |

This phase comprises of two sub-phases; first, designing architecture and second, rapid development. The initial application development calls for the use of rapid development tools, which are: Program Design – the initial system involves internet-based prototyping solutions that are built on the Word Wide Web browsers, employing PHP and Android software. Proposed User Interface – a combined version of Macromedia Dreamweaver MX, Adobe Photoshop, Genymotion, Flash, among others are used. Database – this includes using online MySQL editor for the database and MyAdmin. It is noteworthy that the actual interactive system evaluation can only be empirically conducted if there is system design development and testing. Such evaluations entail the examination of the application design and its comparison with the user’s acceptance requirements.
4.5 Evaluate prototype and recommended changes
The empirical evaluation of prototypes can be conducted [62] and the testing uses actual users in order to assess the system's usability and acceptability [63]. Therefore, it is a must to test the actual user’s use of the system so that their acceptance and adoption of the new application can be assessed. This stage reviews on the initial M-commerce tourism application based on the users in SMTEs. The prototype’s primary aim is to examine the proposed system aspects and therefore, it has to be evaluated based on the objectives of the system. Failure to meet the objectives would need modifications and the final three phases are repeated over and over until the meeting of the objectives.

5 PROTOTYPING METHODOLOGY TOURISM MOBILE COMMERCE PROTOTYPE DESIGN
The process of prototype design entails a conceptual design and physical design [64], and one of the top critical phases of design is the development of new ideas that satisfies the specifications enumerated.

5.1 Conceptual design
The conceptual design is the initial step in prototype building and within this stage, a conceptual model is generated which describes the product, its performance and its appearance [55]. An effective conceptual model is one that is clear to and is suitable for the user [65]. The Use-Case Diagram can be generated in the conceptual design stage to demonstrate and explain the developed software [66]. Based on the user’s perspective, the Use Case Diagrams indicate the application functions that can be made use of [67]. Use case refers to the set of user-system interactions to carry out a specific purpose, with the user specifying the role of each. Initially, use case was employed in developing object-oriented software, after which it was used to create innovative product designs by concentrating on the user experience design [68]. This study made use of use case diagram to demonstrate the employees’ interactions with the system and the tourists as users. The use case diagram of the prototype for SMTEs employees is depicted in Figure 6, while that for tourists is depicted in Figure 7.

Fig.5. Use Case Diagram of the Prototype for SMTEs Employee
5.2 Physical design

The physical design differs from the conceptual design as the former encapsulates certain product features in-depth [65]. Features in the physical design are; appearance and colors, auditory characteristics, images, icons, and menu design [64]. This phase of development ensures that the system and design of the interface provides certain information that is needed for the creation of an effective system [66]. This study indicates that factors significantly influencing user behaviour to use M-commerce prototype. The following features are included in the proposed prototype: Perceived usefulness is the first IS factor in the prototype. Davis [69] referred to perceived usefulness as “the degree to which a person believes that using a particular system would enhance his or her job performance”. The features of usefulness stemmed from the literature and it was revealed that in order to satisfy the needs of users, an application has to be useful in content quality and presentation [70] as well as layout: design [71]. In the present study, perceived usefulness is evidenced by content quality, content presentation, and layout. These are the important features that encourage the acceptance of the tourism M-commerce application among SMTEs. In this context, presentation content is relayed in the most suitable format, where an effective combination of multimedia, through text and pictures, are employed. This prototype also provides coverage and depth of information (helpful information) about services, such as hotels, restaurants, and trips before the process of ‘book’ or ‘reservation’ (refer to Figure 7). In addition, the icons and background (content quality) that was employed in the tourism M-commerce prototype includes a high definition (HD) image. The organisation of information on the tourism M-commerce prototype screen is clear, and the interface of this prototype is pleasant.
Perceived ease of use was reflected as the second important IS factor in the prototype. This feature describes the amount of effort required by the user to use a website, as well as the presence of information that makes communication between customers and the company simple and effective [72]. Ease of use comprises of two subcategories, including quick downloading of web pages and easy interaction with a website [72]. Interaction with the tourism M-commerce prototype is easy for different groups of users (employees in SMTEs and tourists). This prototype consists of interrelated parts in the design of the proposed prototype, namely a part for the SMTE enterprises’ (Part I), and another part for tourists (part II). All the elements that form the interface are developed to bring about the customer-application interaction. Furthermore, our application is able to provide service and information by SMTEs in a timely manner for customers. Moreover, the download time of the pages is suitable in the tourism M-commerce prototype. The third IS factor reflected in the prototype is task-technology fit (TTF). TTF is an established theoretical framework in information system research that enables the investigation of issues based on the fit of technology to tasks as well as performance. According to Wells, et al. [73], content and interactivity dimensions reflect TTF within websites or applications. Several content features stand out when seeing the content from within the information system design context, such as relevant information and complete information. Moreover, for the latter, Palmer [74] and Zhang [75] contended that it is necessary to support the ability of the customer to search for information and to receive effective support after purchasing the tourism M-commerce prototype. In relation to this, Shen and Chuang [76] described machine interactivity as the level that users can take part in tweaking the form and content of a mediated environment in real time using the tourism M-commerce prototype, where SMTE employees can perform their task (add, delete, view and edit) by using their mobile at anytime and anyplace, as shown in Figure 8.
The fourth and fifth IS factors that were reflected in the prototype are task characteristics and technology characteristics. From the TTF point of view, tasks refer to actions carried out by individuals in transforming inputs into outputs in an attempt to meet information requirements [38]. In regards to this, task characteristics refer to those that a user may perform through the use of IT. Tasks are gauged through different dimensions, such as playfulness and simplicity of tasks within websites or applications [77, 78]. In the proposed prototype, task characteristics are represented by simple tasks and playfulness as crucial characteristics that encourage the acceptance of the tourism M-commerce application. Magazine [79] revealed that the interface components are effective ways to lessen perceived complexity, as users will easily get used to the application and won’t have extra expectations. In this context, features can improve a product only if the users are in need of them. In most instances, the dissemination of features can represent complexity with additional icons, such as menu items, toolbars, and dialogue boxes, as these features may prevent the prototype’s efficient and productive performance. In the tourism M-commerce application, the task of payment or making reservations for trips, hotels and restaurants are simple and not very complex, and can be completed by providing icons, menu items, toolbars, and dialogue boxes (refer to Figure 9).

Playfulness is considered to be a feature that needs examination to determine whether or not an the application needs it and to what level. It is notable that playfulness is a critical success feature for particular mobile applications [80]. According to Chou [81], in the context of the mobile information system, playfulness is an important feature to motivate customers to accept and use a system or application, as it plays a role when customers are in the process of searching for information within website or application (refer to Figure 8). The TTF model takes into consideration the significance of aligning functionality and attributes of technology employed to the needs of individuals. The constructed technology attributes are those that users deem as important for portable reading device usability. Technology characteristics are often measured in terms of integrated information and avatars within websites or applications [82]. Finally, technology characteristics refer to the level that tourism information that is provided by the application is well-integrated. As such, integrated information plays a part across products, but not for single products. Using the tourism M-commerce prototype, tourists can get information and services they need, such as prices, hotels, restaurants, trips, news, offers or tourist places. An avatar may also be a technology characteristic, where avatars are virtual representations of the user and can serve as a guide. In computer games, avatars can be in the form of three dimensional, two dimensional (e.g. icon or picture), or one dimensional (e.g. username) [83]. Furthermore, various avatar interfaces can be used with mobile applications interfaces, such as text, audio, video, static images, and cartoons Alowayr and McCrindle [84]. In the tourism M-commerce prototype, avatars (Plain text usernames and static images) are used to represent the presence of the tourists/members in the tourism M-commerce prototype (i.e. reservation or payment process) (refer to Figure 10).
There are three primary reasons mentioned by Preece, et al. [85] as to the necessity of the evaluation phase for usability testing, the first being to understand the way users use technology. The second reason lies in the knowledge of differences and similarities between on prototype to the next and the third reason is to guarantee that the prototype meets a standard level. Steps are taken to verify and validate the prototype during the development phase. For verification, the prototype built is tested for its accuracy, coherence, preciseness and its meeting of specifications. For validation, the prototype is tested for its applicability and its capability of satisfying the desires and aspirations of the user. The latter is generally carried out following the development process to make sure specific desires and requirements of the prototype are met [86].

The verification and the validation (V&V) process is carried out following the development process to make sure specific desires and requirements of the prototype are met [86]. V&V also ensures the satisfaction of the user requirements and needs and without verifying the system, critical errors may arise in the case representations. Also, without validating the system, the system’s decision making may not match that of the needs of the user [86]. Therefore, validation was conducted in this study by inspecting if the functionalities required by the SMTEs are present in the tourism M-commerce prototype and verification was conducted to examine the conformity of the prototype to the requirements enumerated in the earlier phase.

6.1 Verification
During software development the documents and files have to be manually checked to verify the design code [86]. Verification refers to a set of procedures carried out to make sure that the software in any development stage meets the needs enumerated in the earlier stage [88]. A general verification method is the software review, where the product specifications are compared to the requirements of the product and it highlights the presence of any gap. Verification mainly identifies and resolves any errors, preventing failure in the later stages [88]. Also, the expert review is a general and reliable method used to verify new research and development initiatives [89, 90] and it involves professionals with specific expertise to review the interface design. The primary objective is to review and test the system and pinpoint potential problems [91]. The panel of experts’ discussion also assists in mitigating any potential issues between the major stakeholders and in recognizing potential issues that the user may face [92]. Therefore, a minimum of three experts is recommended for the review, all of which are experts in similar fields [93]. In this study, an expert review was conducted to verify the prototype in light of its meeting of requirements that were listed in the initial phase. There were two experts involved from the Department of Software Engineering, Kuala Lumpur Infrastructure University College (KLIUC), and from Al Al-Bayt University, Jordan.

6.2 Validation
Validation is a crucial development life cycle step as within this step, the code is executed and tested, and the software is evaluated to determine if the needs of the users are met and if it works based on what it is intended for [94]. In relation to this, usability is referred to by the International Organization for Standardization as the level to which a product can be used by certain users to achieve specific goals effectively, efficiency and with satisfaction in a certain use context [95]. In other words, validation is done to enhance the usability of the software and it calls for extensively documenting any information that can enhance usability, and by developing validation test plans. In instances, where the development and design is done by a third external party, usability objectives have to be mentioned in the requirements of the software [94]. For the testing of the prototype/system usability, the System Usability Scale (SUS) is generally adopted for its ease of use, and facilitation of subjective usability evaluation [96]. However, the top important advantage of SUS is its appropriate use for various types of consumer interface software throughout different applications range [97]. More specifically, Bangor, et al. [97] evaluated 206
The items were developed and adapted from the main questionnaire that was used to measure the factors impact on the user's behaviour in using M-commerce prototype. This approach is supported by ayyash [56] and Alafeef [55]. Table 5 contains the second part of the questionnaire.

**Table 5 The second part of evaluation questionnaire**

<table>
<thead>
<tr>
<th>Construct</th>
<th>Items</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Perceived Usefulness (PU)</strong></td>
<td></td>
</tr>
<tr>
<td>PU1</td>
<td>This prototype is useful for my job performance.</td>
</tr>
<tr>
<td>PU2</td>
<td>This prototype supports me in attaining my overall performance goals.</td>
</tr>
<tr>
<td><strong>Perceived Ease of Use (PEOU)</strong></td>
<td></td>
</tr>
<tr>
<td>PEOU1</td>
<td>I think that learning to use this prototype would be easy.</td>
</tr>
<tr>
<td>PEOU2</td>
<td>I expect to become or I am already skilled at using this prototype.</td>
</tr>
<tr>
<td><strong>Technology Characteristics (Tec_C)</strong></td>
<td></td>
</tr>
<tr>
<td>Tec_C1</td>
<td>This prototype provides timely notification of urgent interventions that are required.</td>
</tr>
<tr>
<td>Tec_C2</td>
<td>This prototype effectively enables the easy sharing of data with other tourism workers.</td>
</tr>
<tr>
<td><strong>Behavioural Intention (BI)</strong></td>
<td></td>
</tr>
<tr>
<td>BI1</td>
<td>I will use this prototype on regular basis in the future.</td>
</tr>
<tr>
<td>BI2</td>
<td>I will strongly recommend others to use this prototype.</td>
</tr>
</tbody>
</table>

7. **Prototype Evaluation Results**

Under this section, the results obtained from evaluating the tourism M-commerce prototype are presented and discussed. There are two parts to this evaluation results; first verification results and second, validation results.

7.1 **Analysis of Verification Results**

Data analysis involved the calculation of the number of “YES” and “NO” answers of each factor criteria. For the “YES” answer, it shows that the factors are reflected by the prototype in its features, while the “NO” answer shows that the factors are not reflected by the same. The same approach was used for the identification of the usability level of the mobile commerce models that were evaluated by the software engineering experts. The verification test findings for the tourism M-commerce prototype are displayed in Table 6. From the table, it is evident that the verification test findings concerning perceived ease of use, perceived usefulness, task characteristics, technology characteristics and the task-technology fit are indicated. The results are categorized into four sections on the basis of the usability dimensions that were mentioned in the expert review form.
Table 6: Verification Results

<table>
<thead>
<tr>
<th>Factors</th>
<th>Features</th>
<th>Expert 1 Answer</th>
<th>Expert 2 Answer</th>
<th>Expert 3 Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Perceived Usefulness</td>
<td>Content Quality</td>
<td>√</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Presentation Quality</td>
<td>√</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived Ease Of Use</td>
<td>Simple Communication With Website</td>
<td>√</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Contact Us Information</td>
<td>√</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived Task-Technology Fit</td>
<td>Content (The Ability Of Users To Search the Information)</td>
<td>√</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Interactivity (The Ability Of Users To Edit The Information Within The Application)</td>
<td>√</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Task Characteristics</td>
<td>Simple Task</td>
<td>√</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Playfulness</td>
<td>√</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technology Characteristics</td>
<td>Integrated Information</td>
<td>√</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Avatars</td>
<td>√</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 6 shows the results of the verification test for the tourism M-commerce model, in terms of system usefulness, ease of use, task-technology fit, task characteristic, and technology characteristics. The evaluators noted that the prototype provided useful content quality and presentation quality, and was relatively easy to use, as it provided users with the ability to communicate with the company through the website. The prototype also met the requirements of M-commerce technology and SMTEs tasks through content (the ability of users to search the information), interactivity (the ability of users to edit the information within the application), simple tasks, playfulness, integrated information, and the use of avatars. However, expert recommendations after the testing called for future improvements in the tourism M-commerce prototype application, with the following comments: “avatars were not clear on the tourism M-commerce prototype as a feature for technology characteristics”.

7.2 Analysis of Validation Results

For validation, questionnaires were distributed to 22 employees in the SMTEs for their feedback and the sample units were selected from the main sample used for the actual survey. The evaluation helped in the examination of the users’ attitude towards the tourism M-commerce prototype.

7.2.1 Demographic Profile

The SMTEs employees requested to evaluate the tourism M-commerce prototype, as respondents, had different ages, gender, education backgrounds and mobile skills levels. Table 7 tabulates the demographic profile of the respondents.

Table 7: Demographic Profile

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>14</td>
<td>63%</td>
</tr>
<tr>
<td>Female</td>
<td>8</td>
<td>36%</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 24</td>
<td>5</td>
<td>22.7%</td>
</tr>
<tr>
<td>25-29</td>
<td>5</td>
<td>22.7%</td>
</tr>
<tr>
<td>30-34</td>
<td>8</td>
<td>36.4%</td>
</tr>
<tr>
<td>35-39</td>
<td>4</td>
<td>18.2%</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diploma</td>
<td>11</td>
<td>50%</td>
</tr>
<tr>
<td>Bachelor</td>
<td>11</td>
<td>50%</td>
</tr>
<tr>
<td>Level of mobile skills</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Much</td>
<td>12</td>
<td>54.5%</td>
</tr>
<tr>
<td>Very much</td>
<td>10</td>
<td>45.5%</td>
</tr>
</tbody>
</table>

Table 7 shows that majority of the respondents (63%) were male respondents, while the rest (36%) were female respondents. In addition, with regards to their education level, the respondents were split into two equally, 50% were bachelor students and 50% were diploma students. Majority of them had high mobile skills levels (54.5%), while the rest had medium skills (45.5%). The questionnaire had six parts, within which items are listed that were adapted from different sources for data collection regarding SUS, PU, PEOU, PTTF, Tes_C, Tec_C and BI. Each variable was run through descriptive statistics and the results are discussed in this section.

7.2.2 System Usability Scale (SUS)

SUS focuses on the way the respondents use the prototype and the scale used ranged from 1 (strongly agree) to 5 (strongly disagree), with the median scales being 2 (agree), 3 (neutral) and 4 (disagree). Therefore, the factors that obtained mean value of below 3 were regarded as important [101]. The scale measures the way the system can be of assistance to the respondents in obtaining the information they need. The SUS results are presented in Table 8.
Table 8 Mean for SUS Questions

<table>
<thead>
<tr>
<th>Item</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>I think that I would like to use this prototype frequently.</td>
<td>1.8182</td>
<td>.795</td>
</tr>
<tr>
<td>I found the prototype unnecessarily complex.</td>
<td>3.4091</td>
<td>1.259</td>
</tr>
<tr>
<td>I thought the prototype was easy to use.</td>
<td>1.5000</td>
<td>.511</td>
</tr>
<tr>
<td>I think that I would need the support of a technical person to enable me to use this prototype.</td>
<td>1.5455</td>
<td>.670</td>
</tr>
<tr>
<td>I found the various functions in this prototype were well integrated.</td>
<td>1.4545</td>
<td>.509</td>
</tr>
<tr>
<td>I thought there was too much inconsistency in this prototype.</td>
<td>3.7273</td>
<td>1.120</td>
</tr>
<tr>
<td>I would imagine that most people would learn to use this prototype very quickly.</td>
<td>1.4091</td>
<td>.590</td>
</tr>
<tr>
<td>I found the prototype very cumbersome to use.</td>
<td>3.7273</td>
<td>1.241</td>
</tr>
<tr>
<td>I felt very confident using the prototype.</td>
<td>1.5455</td>
<td>.509</td>
</tr>
<tr>
<td>I needed to learn a lot of things before I could go with this prototype.</td>
<td>3.8182</td>
<td>1.139</td>
</tr>
</tbody>
</table>

Table 8 indicates that the mean ranges are from 1.4091 to 3.7273, with standard deviation values ranging from 0.509 to 1.259. The findings show that the respondents’ considerations are useful. The highest mean was obtained by the statement, “I would imagine that most people would learn to use this prototype very quickly”, while the lowest mean was obtained by the statement, “I found the prototype very cumbersome to use” (refer to Figure 11 and 12). It can thus be concluded that users used and tested the prototype and found it to be devoid of complexity, particularly the feedback portion, which ensures quick learning.

![Fig. 11. Statistics Bar Chart of SUS7](image)

I. Task-Technology Fit (TTF)

TTF concerns the reaction of user on using the system. Table 9 presents the TTF results. We can notice that mean ranges from 1.5909 to 1.9091 and standard deviation ranges from .426 to .734 from Table 9. Based on these findings, we can conclude that users are satisfied with the prototype.

Table 9 Mean for TTF Questions

<table>
<thead>
<tr>
<th>Item</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>This prototype supports me in finishing my tasks in a timely manner.</td>
<td>.5909</td>
<td>.734</td>
</tr>
<tr>
<td>This prototype supports me in sharing task information with other tourism workers</td>
<td>1.9091</td>
<td>.426</td>
</tr>
</tbody>
</table>

The question “This prototype supports me in finishing my tasks in a timely manner” has the highest mean of 1.5909 (refer to Figure 13).

![Fig. 12. Statistics Bar Chart of SUS8](image)

![Fig. 13. Statistics bar chart of TTF1](image)
II. Task Characteristics (Tes_C)

Table 10 presents Tes_C results on the concern of user’s reaction on the system. From Table 10, we can notice that mean ranges from 1.6364 to 1.4545 and standard deviation ranges from .509 to .902. Based on these findings, we can conclude that users are satisfied with the prototype.

<table>
<thead>
<tr>
<th>Item</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>This prototype is very important for me to take required urgent action in a timely manner.</td>
<td>1.6364</td>
<td>.902</td>
</tr>
<tr>
<td>This prototype allows me to share task information with co-workers when I need.</td>
<td>1.4545</td>
<td>.509</td>
</tr>
</tbody>
</table>

The question “This prototype allows me to share task information with co-workers when I need” has the highest mean of 1.4545 (refer to Figure 14).

III. Technology Characteristics (Tec_C)

Table 11 presents Tec_C results on the concern of user’s reaction on the system. From Table 11, we can notice that mean ranges from 1.6818 to 1.5000 and standard deviation ranges from .567 to .801. Based on these findings, we can conclude that users are satisfied with the prototype.

<table>
<thead>
<tr>
<th>Item</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>This prototype provides timely notification of urgent interventions that are required.</td>
<td>1.6818</td>
<td>.567</td>
</tr>
<tr>
<td>This prototype effectively enables the easy sharing of data with other tourism workers.</td>
<td>1.5000</td>
<td>.801</td>
</tr>
</tbody>
</table>

The question “This prototype effectively enables the easy sharing of data with other tourism workers” has the highest mean of 1.5000 (refer to Figure 15).

IV. Perceived Usefulness (PU)

PU concerns on how system can be advantageous to users, as well as how the system assists users in obtaining required information. Table 12 presents the usefulness results. From Table 12, we can notice that mean ranges from 1.7727 to 1.8182 and standard deviation ranges from .664 to .751. Based on these findings, we can conclude that users considered the prototype to be useful.

<table>
<thead>
<tr>
<th>Item</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>This prototype is useful for my job performance.</td>
<td>1.7727</td>
<td>.751</td>
</tr>
<tr>
<td>This prototype supports me in attaining my overall performance goals.</td>
<td>1.8182</td>
<td>.664</td>
</tr>
</tbody>
</table>

The question “This prototype is useful for my job performance” has the highest mean of 1.7727 (refer to Figure 16).

V. Perceived ease of use (PEOU)

PEOU concerns on how system can be free from effort, as well
as how the system can be understandable and clear in terms of interaction. Table 13 presents the PEOU results. From Table 13, we can notice that mean ranges from 1.5455 to 1.5909 and standard deviation ranges from .670 to .796. Based on these findings, we can conclude that user considered the usage of ease of use prototype.

**Table 13 Mean of PEOU Questions**

<table>
<thead>
<tr>
<th>Item</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>I think that learning to use this prototype would be easy.</td>
<td>1.5455</td>
<td>.670</td>
</tr>
<tr>
<td>I expect to become or I am already skilled at using this prototype.</td>
<td>1.5909</td>
<td>.796</td>
</tr>
</tbody>
</table>

The question “I think that learning to use this prototype would be easy” has the highest mean of 1.5455 (refer to Figure 17).

**Fig. 17. Statistics bar chart of PEOU1.**

**VI. Behavioural intention (BI)**

BI concerns the behavioural intention to use the system in future as well as how the system can be recommended and intended in terms of behaviour. Table 14 presents the BI results. From Table 14, we can notice that mean ranges from 1.7727 to 1.3636 and standard deviation ranges from .726 to .869. Based on these findings, we can conclude that user intends to use this prototype.

**Table 14 Mean of BI Questions**

<table>
<thead>
<tr>
<th>Item</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>I will use this prototype on regular basis in the future.</td>
<td>1.7727</td>
<td>.869</td>
</tr>
<tr>
<td>I will strongly recommend others to use this prototype.</td>
<td>1.3636</td>
<td>.726</td>
</tr>
</tbody>
</table>

The question “I will strongly recommend others to use this prototype” has the highest mean of 1.3636 (refer to Figure 18).

**Fig. 18. Statistics bar chart of BI2.**

**8 CONCLUSION**

This paper developed and proposed a tourism M-commerce prototype (TMCP) according to the TAM model and TTF model, theoretically supporting the factors positive effect on the user’s behavioural to use M-commerce application among SMTEs. The factors were successful in their reflection within the recommended prototype, which confirms its validation. In the evaluation phase, SUS was evidenced to be a significant, robust and reliable tool. This study used expert review to verify new research and development programs following studies in literature. In sum, SUS and expert review were both adopted for TMCP evaluation and based on the results, BI is significantly affected by PU, PEOU, PTTF, Tec_C and Tes_C in TMCP acceptance. In other words, the results supported the proposed tourism M-commerce model’s effectiveness. This study recommends a lot of features that must be taken into consideration for the tourism M-commerce application design by testing usability, such as the following: Content quality and content presentation are considered important features in M-commerce applications to improve job performance in SMTEs tourism. Simple communication with the application and ‘Contact Us’ information are considered as important features in M-commerce applications to reduce the physical and mental effort for users. Content and interactivity are considered to be important features to help users to perform their tasks when developing the M-commerce applications for SMTEs. Simplicity of tasks and playfulness are considered to be important features to motivate a user to largely depend on M-commerce aspects in the SMTE environment. Integrated product or service information and avatars are considered to be important features to help users to achieve their tasks by using the tourism M-commerce applications. These features have an important role in increasing the acceptance level of M-commerce applications in SMTEs. The present study provides opportunities for further studies to identify the factors that contribute to enhancing user’s behavioural, which has implications for researchers and designers when it comes to designing and developing applications. Lastly, the study suggests that other models be adopted in future studies aside from TAM, TTF, DeLone and McLean’s IS Success model, and perceived trust (e.g., UTAUT) with other factors to be integrated (culture and satisfaction) for...
better comparison of results. This study also suggests that future studies evaluate the TMCP with other methods aside from SUS questionnaire (e.g., interview) for thorough evaluation.

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