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Information system support (IS-Support): Theoretical development and empirical validation

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A B S T R A C T

This study proceeds from a central interest in the importance of assessing the IS-Support provided to key-user groups. This study conceptualized a new multidimensional IS-Support construct with four dimensions: training, documentation, assistance and authorisation, which form the overarching construct – IS-Support. We argue that a holistic measure for assessing IS-Support should consist of dimensions, and measures, that together assess the support provided to IS key-user groups. The proposed IS-Support construct is defined as the support that IS key-user groups receive to increase their capabilities in utilizing information systems within the organization. Using a partial least square structural equation modeling (PLS-SEM) approach on data collected from 221 participants, this study rigorously hypothesized and validated the IS-Support model. Implications for research and practitioners as well as insights for future research is discussed.

1. Introduction

Organizations continue to increase spending on information systems (IS) and IS budgets continue to rise. However, organizations often do not experience the performance gains they expect from their IS investments (e.g., Bergersen, 2004; Rabaa'i, 2012; Seddon et al., 2010). In fact, the benefits realized from these investments being much influenced by the support given to ensure effective use of the system and satisfied users (e.g., Shaw et al., 2002; Shaw et al., 2003; Wixom & Todd, 2005). Notably, various research studies have shown that users' satisfaction with the IS is considerably enhanced by providing IS users with appropriate levels of support (e.g., Myers et al., 1998; Palvia, 1996; Rabaa'i & Gable, 2012; Shaw et al., 2002; Wixom & Todd, 2005).

While IS-Support has long been an important issue to IS academics and practitioners (e.g., Chang & King, 2005; Rabaa'i et al., 2010; Saunders & Jones, 1992; Wixom & Todd, 2005), IS researchers tend to measure IS-Support by evaluating the performance of the Information Services Function (ISF) within the organization. However, the question of how best to measure the ISF performance remains a vexing management challenge given that IS users can receive different types of support from different sources, not just from the ISF, such as: their colleagues, IS application manuals and documentation, external training, etc. Moreover, reviews of the literature suggesting views and related concepts and measures are scattered, limited to a single perspective, and lacking a common theme.

Given the issues in prior IS-Support studies, this paper proceeds from a central interest in the importance of assessing the IS-Support provided to key-user groups. Gable et al., (2008, p. 386) defined key-user groups as *"the main groups of direct users of the IS – those users who access the system directly, or who use its direct outputs"*. The study aims to conceptualize and validate a new multidimensional IS-Support measurement model. The new IS-Support construct, proposed in this study, is

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defined as *"The support the IS key-user groups receive to increase their capabilities in utilizing information systems within the organization"*. The overall study aims to address the main research question: *"How can the support provided to IS key user groups be effectively and efficiently measured?"*

The remainder of this paper is organized as follows: Section 2 presents the theoretical background followed by the proposed research model in Section 3. The research methodology is presented in Section 4 followed by the results and in-depth data analysis in Section 5. Discussions, theoretical as well as practical contributions are explained in Section 6. Section 7 presents the study conclusion, limitations, and future research.

2.0 Theoretical Background

Having the responsibility for providing information systems (IS) users with needed IS-related support (e.g., Rabaa'i, 2010; Rabaa'i, 2015b; Rabaa'i & Gammack, 2014), prior research has generally linked IS-Support to the Information Services Function (ISF) unit within the organization. It is believed that the ISF "is an integral part of achieving organizational success" (Chang & King, 2005, p. 86). Rabaa'i et al. (2010) noted that the ISF is expected to provide various support services to end-users, including: (1) across a variety of different packages and configurations, (2) on hardware and software maintenance, upgrades and installation, and (3) on data backup and recovery, and to provide this support in a cost- and time-effective manner. The perceived importance of the ISF is evident from its prominence in various studies (e.g., Chang & King, 2005; Munkvold, 2003; Rabaa'i and Gammack, 2014; Rabaa'i, 2015b; Rabaa'i et al., 2015; Saunders & Jones, 1992; Shaw et al., 2002; Velsen, et al., 2007). For instance, evidence suggests that poor ISF performance is a serious inhibitor to good business performance (e.g., Carlson & McNurlin, 1992; Chang & King, 2005; Rabaa'i et al., 2010). However, the question of how best to measure the ISF performance remains a vexing management challenge (e.g., Chang & King, 2005; Rabaa'i et al., 2010; Shaw et al., 2002), given that IS users can receive different types of support from different sources, not just from the ISF, such as: their colleagues, IS application manuals and documentation, external training, etc.

Instruments for gauging IS-Support were derived from three main alternative sources: (i) the User Information Satisfaction (UIS) instrument (Iivari, 1987), (ii) a grounded approach yielding a new custom instrument (e.g., Chang & King, 2005), or (iii) the service quality (SERVQUAL) instrument from the marketing literature (e.g., Jiang et al., 2002). To gauge the products and services of the ISF, User Information Satisfaction (UIS), has been frequently employed (Iivari, 1987; Ives et al., 1983; Joshi, 1990). This instrument has been the focus of a series of studies (e.g., Bailey & Pearson, 1983; Ives et al., 1983) which identified its major dimensions as: (1) the quality of information products produced by the ISF; (2) the level of user's knowledge and involvement in system development and ISF activities; and (3) user attitudes towards ISF staff and services. While versions of user satisfaction with the ISF (USISF) instruments have been widely used, research has found problems associated with these measures and has suggested improvements (e.g., Galletta & Lederer, 1989; Iivari, 1987; Joshi, 1990; Melone, 1990). For example, Baroudi and Orlikowski (1988) stated that the original development and subsequent refinement of the USISF measure tended to be in an era of large, centralized transaction processing systems rather than today's personal computing and network-based service environment. Moreover, Zmud (1984) noted that the role of the ISF has changed significantly from principally a manufacturing activity, involving development and operation of large-scale hardware and software systems, to include additional roles of distribution and technology transfer that require higher levels of user interaction and service delivery. Given the changed role of the ISF, researchers have suggested that the USISF instruments' operationalization should incorporate more items and cover additional dimensions to provide richer information (Baroudi & Orlikowski, 1988; Galletta & Lederer, 1989; Joshi, 1990; Melone, 1990). Additionally, other researchers (e.g., Ross, 2011) have reported further changes in the roles of ISF, especially in the use of outsourcing strategies of various IS functions as well as the introduction of cloud computing models, such as software as a service –these IS innovations have further changed the roles of ISF.

Saunders and Jones (1992) developed the "IS Function Performance Evaluation Model" which was used to describe how measures should be selected from multiple dimensions of the IS function relative to specific organizational factors and based on the perspective of the evaluator. The authors reported a Delphi study followed by senior executive interviews aimed at determining the important dimensions and their measures for evaluating IS function performance. Yet, their proposed model had the following issues: (1) the model focused on top management's perspective of IS function performance, (2) they offered very limited and inadequate list of suggested measures for each dimension, and (3) their study sample was relatively small and was taken from firms in only three selected cities in Texas which leads to question the generalizability of the results. Based on a theoretical input-output model of the IS function's role in supporting business process effectiveness and organizational performance, Chang and King (2005) developed a functional scorecard to measure IS Performance. The instrument consists of 18 unidimensional factors (i.e., measures) within the three model dimensions: systems performance, information effectiveness, and service performance. Generated items were refined through two round Q-sort techniques described by Moore and Benbasat (1991). However, the authors cautioned the use of the instrument until it is revalidated, as the sample size was relatively small. On the other hand, some items, such as: "IS training" and "flexibility of services", were borderline with respect to reliability. The authors stressed the need for further studies to explore and improve these items.

Several researchers (e.g., Jiang et al., 2002; Kettinger & Lee, 1994, 2005; Rabaa'i & Gable, 2012; Shaw et al., 2002; Watson et al., 1998) recognized the importance of the services provided by the ISF and adapted the service quality (SERVQUAL) measure, originally developed in marketing (Parasuraman et al., 1991), to measure the quality of the services provided by the ISF. By using the SERVQUAL instrument, Shaw et al., (2002), for example, examined support factors across multiple user groups. They looked at the gap between support level expected and support level provided for each of the support factors

examined and for each of the user groups. Their results showed larger gaps in IS staff response time, staff technical competence, software upgrades, ease of access to computing facilities, documentation to support training, cost effectiveness of systems, users understanding of the system, and data security and privacy. Shaw et al., (2002) had a generally dissatisfied user population and concluded that future studies should test the robustness of their results with a more highly satisfied user group.

Based on the literature review, we have identified a number of issues associated with prior research examining IS function's support. These include:

- *Choice of Dimensions and Measures:* DeLone & McLean (1992) suggest that in order to develop a comprehensive measurement model and instrument for a particular context, the dimensions and measures should be systematically selected considering contextual contingencies, such as organization size or structure, or the technology and the individual characteristics of the system. On the other hand, Burton-Jones and Straub, (2006) introduced a two-step approach for selecting measures for a study. They emphasized the importance of considering the "structure" and "function" of measures, where structure refers to the selection of elements (dimensions) that are most relevant for the research model and context; and function refers to the selection of measures for the chosen elements that tie the constructs into a nomological network. However, most prior IS function's support studies did not address these issues, nor elaborate the rationale for their choice of IS function's support dimensions and measures employed.
- *Theoretical Basis:* Considering the IS function as a service and applying the principles of service quality can yield many opportunities to show the value of the IS function to the organization. But measuring service quality is difficult and often ambiguous (Cheng & Ngai, 1994). Moreover, the use of SERVQUAL instrument, for example, have been the subject of considerable debate (Kettinger & Lee, 1994; Parasuraman et al., 1993; Pitt et al., 1997; Van Dyke et al., 1997; VanDyke et al., 1999). The focus of the debate concerns calculating differences between two possibly different constructs, expectations and perceptions (Rabaa'i & Gable, 2012). Various issues associated with the use of IS SERVQUAL are discussed by Tate and Evermann (2010), Rabaa'i (2010), and Rabaa'i and Gable (2012). This lack of theoretical grounding raises concerns about the validity of the instrument. Additionally, while service quality measures are important for assessing the IS function, using them alone in an assessment procedure will not provide a thorough understanding of the total contribution of the IS function to the organization.
- *Construct Validity (Formative vs. Reflective):* Prior research examining IS function's support has not carefully addressed the nature of the support construct as either formative or reflective. Petter et al., (2007) has cast doubt on the validity of many mainstream constructs employed in IS research over the past three decades; critiquing the almost universal conceptualization and validation of these constructs as reflective when in many studies the measures appear to have been implicitly operationalized as formative. Reflective constructs have observed measures that are affected by an underlying latent, unobservable construct (MacCallum and Browne 1993), while formative constructs are a composite of multiple measures. Petter et al. (2007) suggests that there is a significant threat of mis-specifying and validating constructs as "reflective" (MacCallum & Browne, 1993) that on closer scrutiny are in fact "formative". Misspecification of constructs as formative or reflective results in measurement error, which impacts the structural model, thereby increasing the potential for type I and type II errors (Gable et al., 2008, p. 379).
- *Different End-Users:* With the exception of few past studies concerned with IS function's support (e.g., Shaw et al., 2002), much prior research has treated users as a single homogenous group. It is, however, likely that any large organization will have a range of users, from different employment cohorts, for whom different support will have varied levels of salience. In fact, it has been theorized that diversity among end-users calls for *"strongly differentiated education, training, and support for the quite different classes of users"* (Rockart & Flannery, 1983, p. 778). Thus, different end-users may result in different support needs.

In summary, while prior research studies offered several avenues to measure IS function's support, IS researchers have very often focused on only a specific aspect or a specific measure of IS function's support. IS function's support studies identified and used both subjective and objective measures of support, have employed many methodologies such as case studies and surveys, and varied greatly in terms of research scope, perspective, paradigm, assessment level, and context. In fact, existing discussions on this issue are scattered, limited to a single perspective, cannot be aggregated in any comprehensive way, and lack a common theme. Consequently, no commonly accepted measure of ISF's performance, that encompasses all appropriate and significant sets of IS function's support measures, has appeared.

3. The Proposed Research Model

The proposed model of this study intends to address the previously mentioned issues by: (1) following the guidelines of Burton-Jones & Straub (2006) for operationalizing dimensions and identifying measures; (2) following the guidelines suggested by Gable et al., (2008) to provide the theoretical rigor in developing the measurement model; (3) the gathered dimensions and measures will be assessed against the characteristics of *Analytic Theory* proposed by (Gregor, 2006); and (4) capturing multiple end-users perceptions, from different employment cohorts, of IS function's support.

3.1 The Conceptual Model

Consistent with Au et al., (2002) and Chang and King (2005) description/notation of support, this study proceeds from the assumption that IS-Support is a multidimensional construct. We argue that a holistic measure for assessing IS-Support should

consist of dimensions, and measures, that together assess the variety of support provided to IS key-user groups. In this study, the IS-Support construct is defined as *"the support the IS key-user groups receive to increase their capabilities in utilizing information systems within the organization"*.

The IS-Support construct conceptualized in this study is dissimilar to SERVQUAL in that the former is the extent to which the support is available to IS users (i.e., evaluating the existence of support), where the latter is: *"the quality of the support that system users receive from the IS department and IT support personnel. For example: responsiveness, accuracy, reliability, technical competence, and empathy of the personnel staff"* (Petter et al., 2008, p. 239) (i.e., evaluating the quality of support). For instance, in an online-services, Business-to-Consumer, context, Cenfetelli et al., (2008) make a similar distinction between Supporting-Services Functionality (SSF) and Service Quality. The authors state that *"SSF is the extent to which IT artifacts exist to provide supporting services around a core product or service, whereas service quality is the evaluation of how well those supporting services are delivered"* (Cenfetelli et al., 2008, p. 165). Figure 1 depicts the IS-Support conceptual model.

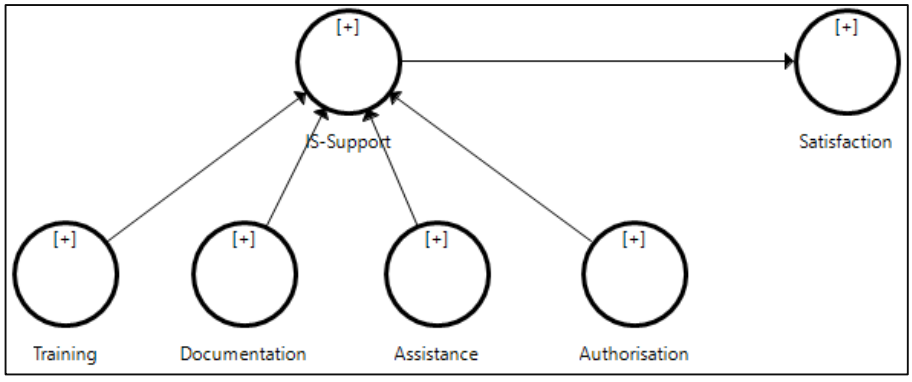

Fig. 1. The IS-Support Conceptual Model

Fig. 1 shows that the four clusters (i.e., sub-constructs: training, documentation, assistance and authorisation) are grouped together to form the IS-Support construct. That is, the four dimensions: training, documentation, assistance and authorisation, form the overarching construct – IS-Support. **Error! Reference source not found.** provides the definitions of these dimensions.

Table 1
Definitions of the four dimensions of the IS-Support construct

Dimension	Definition
Training	The amount and adequacy of specialized instructions and practices that is provided to [the IS's] users.
Documentation	The recorded description of [the IS]. This includes formal instructions for the use of [the IS].
Assistance	The availability and ease of getting help on problems with the data/information.
Authorisation	The ease of getting approval to get access to required data/information.

3.2 Analytic Theory Aspects of the Proposed IS-Support Model

Analytic (or Type 1) theory, the most basic type of theory, is necessary for the development of all of the other types of theory Gregor (2006). In Building a classification model, framework, or a taxonomy, the analytic theory is an important initial step towards building a theory and to derive a deeper understanding of a phenomena of interest. *"They describe or classify specific dimensions or characteristics of individuals, groups, situations, or events by summarizing the commonalities found in discrete observations"* (Gregor, 2006, p. 623). Analytic theory seeks to answer "What is" question as opposed to explaining causality or attempting predictive generalizations is the essence of the approach (Gregor, 2006).

Hence, akin to analytic theory (Gregor, 2006), IS-Support is conceptualized as a formative, multidimensional construct, wherein the dimensions form the overarching construct – IS-Support. Good analytic theory should manifest strong positive qualities of: (1) model completeness – include all relevant dimensions and measures, where any ill-conceived additions or omissions good and bad, high and low, positive and negative may critically mask, neutralize or distort results, (2) model parsimony – where only the simplest and smallest relevant dimensions and measures are included, and (3) mutual exclusivity - where each measure addresses a unique aspect of the construct without having overlapping measures. Thus, we evaluate the IS-Support model in terms of these qualities.

3.3 Specifying the Proposed IS-Support Model

As previously described, the IS-Support construct is conceptualized as a multidimensional construct. However, how a multidimensional construct is operationalized may influence analytical results of research models (e.g., Jarvis et al., 2003; Petter et al., 2007; Vlachos & Theotokis, 2009). Therefore, it is essential to carefully conceptualize the relationship between the

first-order dimensions and their indicators and between lower-order dimensions and the higher-order construct (Polites et al., 2011).

We conceptualized the proposed IS-Support construct as a reflective first-order, formative second-order model (i.e. Type II in Jarvis et al., (2003) specification of multidimensional constructs). As mentioned previously and noted in Figure 1, the IS-Support construct is formed from four first-order dimensions: training, documentation, assistance and authorisation. Cumulating these four related dimensions of IS-Support construct entails that the dimensions collectively contribute to the second-order IS-Support construct, which can elucidate their collective effect. However, these four dimensions are likely to change over time and be affected in a different way by other factors. For instance, IS-Support provided to users may be of different levels of effectiveness and efficiency. As such, one would be mistaken to easily trade, for example, training provided to an IS application users for the documentation of the IS application provided to its users. Also, a change in the assistance provided to an IS application users, for example, does not imply a similar change in the authorisation granted to the IS application users to access data/information; thereby making a reflective model less likely. Hence, these imply that training, documentation, assistance and authorisation affect the IS application support in a formative way. On the other hand, the four first-order dimensions of the IS-Support construct are conceptualized and measured reflectively. For example, the training dimension is manifested by such measurable reflective indicators as the amount of training and adequacy of training provided to the IS application users. The other three dimensions are the same, reflected by their measurement indicators.

Additionally, since the IS-Support is conceptualized as reflective first-order, formative second-order construct, Diamantopoulos and Winklhofer (2001, p. 272) proposed that researchers correlate formative items with a *"global item that summarizes the essence of the construct"*. That is, estimating formative indicators' correlations with an external indicator (i.e. external to the formative construct) (Diamantopoulos et al., 2008). Assuming that the overall measure is a valid criterion measure, the relationship between a formative indicator and the overall measure indicates formative indicator validity (Diamantopoulos et al., 2008, p: 13; Diamantopoulos & Winklhofer, 2001, p: 272). As such, two criterion measures, ***CM1:*** *Overall, ALESCO support is substantial, and* ***CM2:*** *Overall, ALESCO support is helpful*, were used to assess the validity of the IS-Support construct.

3.4 The Satisfaction Construct

With the goal of assessing the nomological validity of IS-Support construct (i.e., identification through structural relations), 'Satisfaction' was included in the study model as its immediate consequence. A nomological network includes a theoretical framework of research objects, an empirical framework of how these objects will be measured, and specification of the relationships between these two frameworks (Campbell & Fiske, 1959). Nomological validity is evidenced where the formative construct behaves within a net of hypotheses as expected (Diamantopoulos & Winklhofer, 2001; Henseler et al., 2009; Urbach & Ahlemann, 2010).

Research into user satisfaction in the IS literature has been ongoing for decades and continues to be of interest to academics and practitioners, across the life-cycle of the IS. In marketing research, Oliver and Swan (1989) define satisfaction as the consumer's fulfilment response. From an IS perspective, Doll and Torkzadeh (1988) define user satisfaction with an IS as the affective attitude towards a specific IS application by someone who interacts with the application directly. User satisfaction is probably the most extensively used single measure for IS evaluation (e.g., Au, Ngai, & Cheng, 2008; Au et al., 2002; Briggs et al., 2008; Doll & Torkzadeh, 1988; Igbaria & Tan, 1997; Iivari, 1987). However, despite the large amount of research that has been done on IS user satisfaction, with several widely cited studies and standard instruments that measure user satisfaction with IS (e.g. Bailey & Pearson, 1983; Baroudi & Orlikowski, 1988; Doll & Torkzadeh, 1988), several authors (e.g., Au et al., 2002; Goodhue, 1995; Iivari, 1997; Khalifa & Liu, 2004) noted a range of conceptual problems related to IS user satisfaction instruments, and empirical evidence of their efficiency has yielded mixed and contradictory results (Delone, 1988; Klenke, 1992). For example, Zviran and Erlich (2003) claim that the IS user satisfaction concept is used to refer both to the IS function and to a single IS application without always making clear the distinction between the two. Zviran and Erlich (2003, p. 87) postulate that: *"measures of user satisfaction with the information system function suffer from severe limitations as a measure of user satisfaction with a single application"*

In this study we conceptualized satisfaction as an immediate consequence of IS-Support construct; mainly with the goal of assessing it's nomological validity. The notion of having satisfaction as an immediate consequence of IS-Support construct has support in the literature, as various research studies have shown that users' satisfaction with the IS application is considerably enhanced by providing IS application users with appropriate levels of support (e.g. Rabaa'i & Gable, 2012; Shaw et al., 2002; Wixom & Todd, 2005).

Prior satisfaction instruments from the IS literature, such as Ives et al.'s (1983) user information satisfaction (UIS) scale or Doll and Torkzadeh's (1988) end-user computing satisfaction (EUCS) scale, are not employed in this study for the following reasons: these scales conceptualized satisfaction as a collection of beliefs about the information provided by an IS (e.g., accuracy, format, timeliness, reliability), rather than as affect toward the IS itself; and these scales have been found to mix measures of multiple dimensions of IS success rather than measuring satisfaction. In this study, the satisfaction construct is measured using four indicators adopted from the overall satisfaction scale developed by Spreng et al. (1996) in the Expectation-confirmation theory (ECT) (Oliver, 1997) literature, which is yet considered a central theory for explaining satisfaction

in marketing research (Cenfetelli et l., 2008) and was validated in the IS literature (e.g., Rabaa'i, 2012; Rabaa'i, 2015a; Rabaa'i, 2017 a, b; Rabaa'i and ALMaati, 2021, Rabaa'i et al., 2015, 2018, 2021, 2022).

4.0 The Research Method

A survey-based instrument was utilized to collect the empirical data needed to evaluate the conceptual model depicted in Figure 1. The measuring items, the study sample, and the data collection technique are all described in this section.

4.1 Measurement Instrument

IS literature strongly recommends relying on existing and pre-validated measurement indicators where available (e.g., Boudreau et al., 2001; DeLone & McLean, 1992, 2003) for two reasons: (1) using pre-validated measurement indicators, which have been proven to be high quality in terms of validity and reliability, will enable researchers to measure the same constructs in the same way in different settings, which in turn, will improve measurement of dependent as well as independent variables (Straub, 1989), and (2) indicators development requires extensive time and resources (e.g., Lewis et al., 2005). Table 2 provides a description of the IS-Support model's dimensions and the adopted indicators and their lineage.

Table 2
The IS-Support model's dimensions and indicators

Training: The amount and adequacy of specialized instructions and practices that is provided to [the IS's] users.			
Measure		**Description**	**Adopted from**
Tra1	Amount of training	There is not enough training for me on how to find, understand, access or use [the IS].	Karimi et al., (2004); Kositanurit et al., (2006); Shin (2003).
Tra2	Adequacy of training	I am getting the training I need to be able to use [the IS] effectively in my job.	Karimi et al., (2004); Kositanurit et al., (2006); Shin (2003);
Documentation: The recorded description of [the IS]. This includes formal instructions for the use of [the IS].			
Measure		**Description**	**Adopted from**
Doc1	Usefulness of the manuals	The content of the user manual is useful.	Kositanurit et al., (2006); Etezadi-Amoli et al., (1996)
Doc2	Usefulness of the manuals' index	The index of the user manual is useful	Kositanurit et al., (2006); Etezadi-Amoli et al., (1996)
Doc3	Currency of the manuals	The user manual is current (up to date).	Kositanurit et al., (2006); Etezadi-Amoli et al., (1996)
Doc4	Completeness of the manuals	The user manual is complete	Kositanurit et al., (2006); Etezadi-Amoli et al., (1996)
Doc5	Understandability of the manuals	The user manual is easy to understand and follow.	Kositanurit et al., (2006); Etezadi-Amoli et al., (1996)
Assistance: The availability and ease of getting help on problems with the data/information.			
Measure		**Description**	**Adopted from**
Asst1	Availability of assistance	I am getting the help I need in accessing and understanding the data.	Goodhue (1995); Karimi et al., (2004); Kositanurit et al., (2006).
Asst2	Easy to get assistance	It is easy to get assistance when I am having trouble finding or using data.	Goodhue (1995); Karimi et al., (2004); Kositanurit et al., (2006).
Authorisation: The ease of getting approval to get access to required data/information.			
Measure		**Description**	**Adopted from**
Auth1	Right authorisation	Data that would be useful to me are unavailable because I do not have the right authorisation.	Karimi et al., (2004); Kositanurit et al., (2006); Goodhue (1995)
Auth2	Easy to get authorisation	Getting authorisation to access data that would be useful in my job is time consuming and difficult.	Karimi et al., (2004); Kositanurit et al., (2006); Goodhue (1995)
Auth3	Data Protection	Data are safeguarded from unauthorized changes or use.	Karimi et al., (2004).

In addition to the 12 reflective indicators used to measure the four first-order dimensions of the IS-Support construct, two criterion measures were used to assess the validity of the IS-Support model, as it is conceptualized as first-order reflective, second-order formative. These two criterion measures are newly developed t researcher. **Error! Reference source not found.** provides a description of these criterion measures.

Table 3
The criterion measures used to validate the IS-Support model

Measure	**Descriptive**	
CM1	Individual Impact Criterion Measure (1)	Overall, [the IS] support is substantial.
CM2	IS-Support Global Criterion Measure (2)	Overall, [the IS] support is helpful

As discussed previously in this study, the Satisfaction construct is conceptualized as an immediate consequence of the IS-Support model to assess its nomological validity (i.e., identification through structural relations). In this study, the satisfaction construct is measured using four indicators adopted from the overall satisfaction scale developed by Oliver (1997). This adopted scale captured respondents' satisfaction levels (both in intensity and direction) along seven-point scales anchored between four semantic differential adjective pairs, including: *"frustrated/contented", "displeased/pleased", "terrible/delighted", and "dissatisfied/satisfied"* (Bhattacherjee, 2001).

After the above indicators had been adopted for the IS-Support model, a series of academic and expert focus groups was conducts. The academic focus groups involved: (1) the research team, (2) leading IS professors, and (3) a number of post-graduate students. These focus groups aimed to evaluate the adopted indicators in relation to the qualities of Analytic Theory

as proposed by Gregor (2006), including: eradication of redundant indicators, mutually exclusivity of the dimensions, completeness of the indicators, and parsimony of the indicators. On the other hand, the expert focus groups involved the research team and four senior human resources managers at a public university in Queensland-Australia. These focus groups aimed to ensure that the adopted indicators are applicable, complete, and cover the IS-Support domain in relation to the unit of analysis of this research study.

4.2 Sample and Data Collection

The data was collected from key-users of a human resources IS application (called ALESCO) in a public university in Queensland - Australia. The data was gathered through an online questionnaire that was distributed to the participants. A convenient sampling approach was used. A total of 221 surveys were gathered.

Respondents were asked to specify their employment duration at the university. Fig. 2.A depicts the classification of the respondents by their employment duration at the university. Only a small portion, 9% of the respondents, had been employed at the university for less than a year, while 50% had been employed at the university for 5 years or more. Respondents were also asked to specify their employment duration in their current roles. Fig. 2.B depicts the classification of the respondents by their employment duration in their current roles. 18% of the respondents had been employed in their current roles for 5 years or more. In contrast, 30% had been employed in their current positions for less than 1 year, while 27% and 25% had been employed in their current positions from 1 year and less than 3 years and from 3 years and less than 5 years respectively.

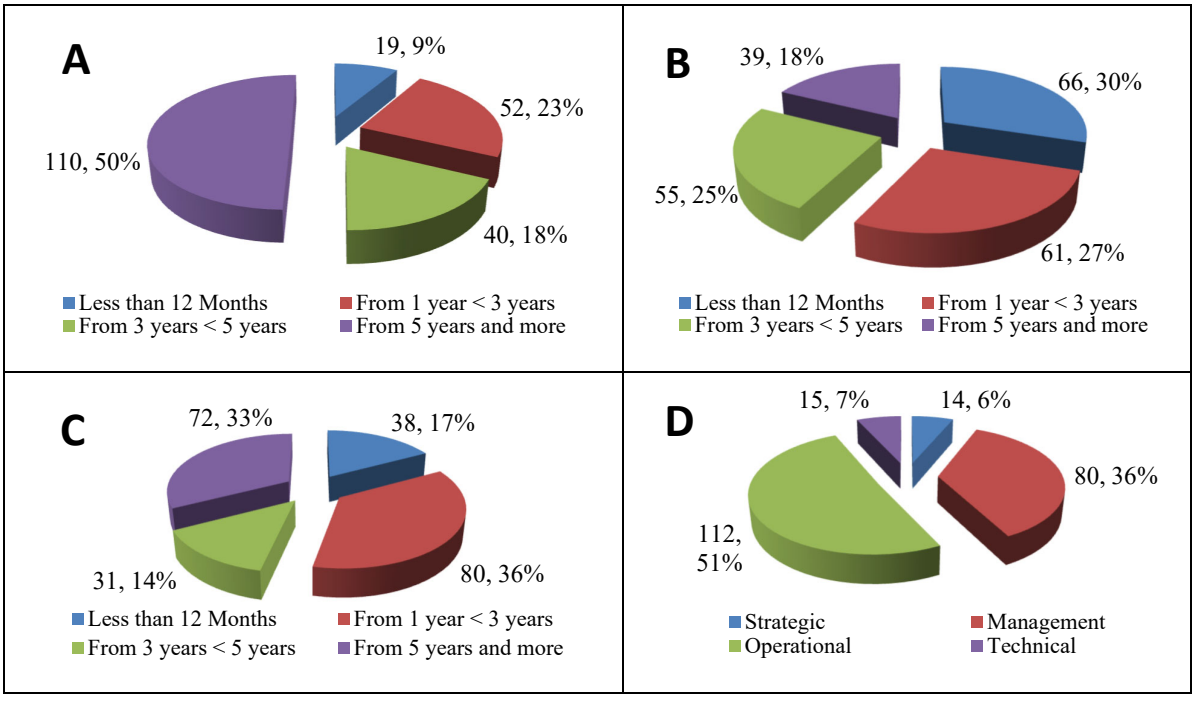

Fig. 2. Sample Characteristics

Respondents were asked to indicate their involvement with ALESCO by specifying how long they had been using the IS application. Fig. 2.C shows that only 17% of the respondents had been using the ALESCO for less than 1 year. On the contrary, 33% had been using the system for 5 years or more, while 50%, in total, had been using the system for at least 1 year and less than 5 years. Finally, responses were classified according to the respondents' employment cohorts (i.e., strategic, management, operational and technical). It is observed that 6% of respondents are Strategic users of ALESCO, 36% Management users, 51% Operational users and 7% Technical users. The sizable percentage of each one of the four employment cohorts suggests the representativeness of the sample for the purpose of validating the research model. While the percentages of Strategic and Technical users are relatively small, compared to the percentages of Management and Operational users, the sample classification according to respondents' employment cohorts suggest that this distribution is representative of all ALESCO users at this institution.

4.3 Descriptive Analysis

The collected data was screened using SPSS 23, in order to report on its distribution. Table 4 provides descriptive statistics results for each item on the final questionnaire. These results show that in every instance, the full range of possible responses was recorded. The reported skewness and kurtosis statistics for each individual scale item do not exceed the suggested thresholds (skewness < 2 and kurtosis < 7), as suggested by Stevens (2001).

Table 4
Descriptive statistics

Item-ID	Item	N	Min	Max	Mean	STD	Skewness	Kurtosis
Tra1	Appropriateness of Training	221	1	7	4.317	1.621	-0.116	-0.854
Tra2	Amount of Training	221	1	7	3.923	1.498	0.051	-0.473
Doc1	Usefulness of the Content	221	1	7	3.801	1.390	-0.069	-0.115
Doc2	Usefulness of the index/table of content	221	1	7	3.760	1.318	-0.126	0.130
Doc3	Currency	221	1	7	3.710	1.327	-0.126	0.180
Doc4	Completeness	221	1	7	3.692	1.370	-0.082	0.118
Doc5	Easy to understand and follow	221	1	7	3.828	1.354	-0.193	0.128
Asst1	Availability	221	1	7	4.095	1.451	-0.050	-0.324
Asst2	Easiness	221	1	7	4.167	1.484	-0.013	-0.483
Auth1	Ease-of-Access	221	1	7	3.068	1.695	0.741	-0.219
Auth2	Timeframe	221	1	7	3.281	1.627	0.420	-0.579
Auth3	Safeguarded	221	1	7	4.914	1.442	-0.693	0.481

Criterion Measures of the IS-Support construct

Item-ID	Item	N	Min.	Max	Mean	Std. Deviation	Skewness	Kurtosis
CM1	IS-Support CM1	221	1	7	4.041	1.493	-0.012	-0.498
CM2	IS-Support CM2	221	1	7	4.271	1.467	-0.262	-0.278

Item-ID	Item	N	Min	Max	Mean	Std. Deviation	Skewness	Kurtosis
Sat1	Contented	221	1	7	4.240	1.698	-0.246	-0.650
Sat2	Pleased	221	1	7	4.299	1.502	-0.236	-0.232
Sat3	Delighted	221	1	7	4.140	1.211	-0.241	0.879
Sat4	Satisfied	221	1	7	4.335	1.625	-0.265	-0.549

4.4 Non-response Error

After the data collection procedure, non-response error can be evaluated by verifying that the responses of early and late respondents do not differ significantly (Urbach & Ahlemann, 2010). The underlying assumption of the comparison of early and late respondents differences (CELRD) is that late respondents are more likely to resemble non-respondents than early respondents (Armstrong & Overton, 1977). While there is an associated risk to assume that late respondents are similar to non-respondents, Sivo et al. (2006) found this method to be used by 19.6% of the studies they considered in their research. In employing the CERLD method, a Chi-square test for equal distribution was implemented on the IS-Support model's dimensions as well as on the Satisfaction construct. The 20th and 80th percentiles were used as surrogates for early and late respondents respectively. Table 5 summarizes the results.

Table 5
Chi-square test for early vs. late responses

Sub-Construct	p-value
Training	0.200
Documentation	0.547
Assistance	0.388
Authorisation	0.248
Satisfaction	0.172

The results indicate that there are no significant differences (at a 0.05 confidence level) in the distributions of early versus late respondents. Hence, it can be concluded that non-response error did not affect the data in this sample.

5. Data Analysis and Results

Partial least squares of structure equation modeling (PLS-SEM) was employed to examine the research model using SmartPLS 3.2.9 software (Ringle et al., 2015). The PLS-SEM method can be used to (1) model formative constructs, (2) easily model multidimensional constructs (Wetzels et al., 2009), (3) investigate complex cause–effect interactions (e.g., Hair et al., 2014; Henseler et al., 2009; Sarstedt et al., 2014), and (4) evaluate and validate the suggested model as well as the hypothesized relationships among the constructs (e.g., Hair et al., 2014, 2017; Hammouri et al., 2022; Rabaa'i, 2015 a, b; Rabaa'i, 2012, 2016, 2017b; Rabaa'i et al., 2015, 2018, 2021, 2022; Rabaa'i & Zhu, 2021; Zogheib et al., 2015; Rabaa'i in press a, b). The data was analyzed in two steps, as recommended by Hair et al., (2017): assessment of the measurement model and assessment at the construct level.

5.1 Assessment of the Measurement Model

According to MacKenzie et al., (2011, p. 317) the goal of evaluating the measurement model is to evaluate whether the indicators of the focal construct (1) are accurate representations of the underlying construct (through experimental manipulation or comparing groups known to differ on the construct), (2) adequately capture the multidimensional nature of the construct, (3) are distinguishable from the indicators of other constructs (discriminant validity), and (4) are related to the measures of other constructs specified in the construct's theoretical network (nomological validity). Additionally, Ringle et al., (2012, p: viii) argued that a multiple indicator multiple cause (MIMIC) models permit the testing of formative construct validity.

As discussed previously, the IS-Support construct is a first-order reflective, second-order formative construct and the Satisfaction construct is a reflective construct. This section is divided into two parts, including: assessment of the first-order reflective IS-Support construct as well as Satisfaction and assessment of the second-order formative IS-Support construct.

5.1.1 Assessment of the First-Order 'Reflective' IS-Support

This section reports on the tests for internal consistency, items' loadings, convergent validity and discriminant validity of the reflective items of the first-order IS-Support construct and the Satisfaction construct. Internal consistency reliability and indicators' reliability were evaluated. Specifically, Cronbach's Alpha (Cronbach, 1951), Composite Reliability (Werts et al., 1974) and examination of item loadings (Carmines & Zeller, 1979) and cross-loadings (e.g., Yoo & Alavi, 2001) were used. The results for the reflective indicators are shown in Table 6.

Table 6
Reflective indicators loading, Cronbach's alpha, and composite reliability

Indicators	Loading	Cronbach's Alpha	Composite Reliability
Tra1	0.9837		
Tra2	0.9849		
TRAINING		0.9678	0.9841
Doc1	0.9461		
Doc2	0.9632		
Doc3	0.9443		
Doc4	0.9432		
Doc5	0.9721		
DOCUMENTATION		0.9752	0.9806
Asst1	0.9333		
Asst2	0.9595		
ASSISTANCE		0.9427	0.9632
Auth1	0.8420		
Auth2	0.8887		
Auth3	**0.2755**		
AUTHORISATION		**0.4100**	**0.7385**
Sat1	0.9211		
Sat2	0.9601		
Sat3	0.8950		
Sat4	0.9544		
SATISFACTION		0.9502	0.9641

Items with potential issues (low Cronbach's Alpha, low Composite Reliability, or loadings lower than 0.70) are candidates for deletion and are indicated in bold-face type. All scales, with one exception, show that the indicators are robust in terms of their internal consistency reliabilities as indexed by the composite reliability and Cronbach's alpha scores which are well above 0.70, the recommended threshold value (Nunnally, 1978).

The exception, Authorisation, with a Composite Reliability of 0.7385 and a Cronbach's Alpha of 0.41, is below the generally accepted level, so items should be dropped to improve its reliability. Through dropping the lowest loading item, Auth3, from the Authorisation dimension and re-running the analysis iteratively, the Composite Reliability score improved from 0.7385 to 0.9209 and the Cronbach's Alpha from 0.41 to 0.8292. Likewise, the loading for Auth1 increased from 0.8420 to 0.9112 and Auth2 from 0.8887 to 0.9362. The revised Authorisation scale is shown in Table 7.

Table 7
The revised Authorisation scale

Indicators	Loading	Cronbach's Alpha	Composite Reliability
Auth1	0.9112		
Auth2	0.9362		
AUTHORISATION		0.8292	0.9209

The average variances extracted (AVEs) for the reflective IS-Support construct dimensions and the Satisfaction construct range from 0.8534 to 0.9688. Consistent with the recommendation of Fornell and Larcker (1981), the AVE for each reflective latent variable (LV) well exceeds the lower bound threshold value of 0.50. Table 8 depicts the results.

Table 8
The average variance extracted for each reflective LV

Latent Variable	AVE
Training	0.9688
Documentation	0.9098
Assistance	0.8972
Authorisation	0.8534
SATISFACTION	0.8705

Table 9 provides evidence of the discriminant validity of the reflective indicator scales used in this study. The bolded items in the matrix diagonals, representing the square roots of the AVEs, are greater in all cases than the off-diagonal elements in their corresponding row and column, supporting the discriminant validity of the reflective scales.

Table 9
Discriminant validity (inter-correlations) of the reflective scales

Latent Variable	Training	Documentation	Assistance	Authorisation	Satisfaction
Training	**0.9843**				
Documentation	0.2954	**0.9538**			
Assistance	0.4351	0.2814	**0.9238**		
Authorisation	0.3392	0.1473	0.2919	**0.9238**	
SATISFACTION	0.5057	0.4182	0.4682	0.3689	**0.9330**

The convergent validity of the reflective scales was assessed by extracting the factor loadings (and cross loadings) of all items to their respective LVs. These results, shown in Table 10, indicate that all items loaded: (1) on their respective LVs from a lower bound of 0.8950 to an upper bound of 0.9849 and (2) more highly on their respective LV than on any other LVs (the non-bolded factor loadings). A common rule of thumb to indicate convergent validity is that all items should load greater than 0.7 on their own construct, and should load more highly on their respective construct than on the other constructs (e.g. Yoo & Alavi, 2001).

Table 10
Factor loadings (bolded) and cross loadings

Indicators	Training	Documentation	Assistance	Authorisation	Satisfaction
Tra1	**0.9837**	0.5088	0.3726	0.3266	0.4832
Tra2	**0.9849**	0.5446	0.3242	0.3409	0.5117
Doc1	0.5276	**0.9461**	0.1405	0.1264	0.4711
Doc2	0.5235	**0.9632**	0.3721	0.1037	0.4660
Doc3	0.4523	**0.9443**	0.4311	0.1433	0.4764
Doc4	0.5065	**0.9432**	0.2586	0.1617	0.5002
Doc5	0.5410	**0.9721**	0.3149	0.1667	0.5091
Asst1	0.4146	0.2906	**0.9333**	0.3830	0.4775
Asst2	0.3431	0.2263	**0.9595**	0.4068	0.4512
Auth1	0.2686	0.1292	0.3150	**0.9112**	0.2912
Auth2	0.3521	0.1421	0.4028	**0.9362**	0.3837
SAT1	0.5284	0.4667	0.4888	0.4005	**0.9211**
SAT2	0.4600	0.5039	0.4082	0.2836	**0.9601**
SAT3	0.4178	0.4315	0.3636	0.3138	**0.8950**
SAT4	0.4733	0.4909	0.4749	0.3718	**0.9544**

5.1.2 Assessment of the Second-Order 'Formative' IS-Support

The validation of formative models requires different procedures and techniques than those applied with reflective models (e.g., Ali et al., 2012; Götz et al., 2010; Henseler et al., 2009; Urbach & Ahlemann, 2010). That is, traditional validity assessments do not apply to formative models (e.g., Diamantopoulos, 2006; Diamantopoulos & Siguaw, 2006; Götz et al., 2010; Rabaa'i & Gable, 2012; Rabaa'i, 2017a). Diamantopoulos (2006, p. 11) states, with respect to formative models, that *"reliability becomes an irrelevant criterion for assessing measurement quality"*. It is the assumption of error-free measures that makes the question of indicator reliability irrelevant (Henseler et al., 2009). Unlike reflective indicators, the error term in a formative structure has no measurement error but rather a disturbance term, which represents the remainder of the construct domain unexplained by the presented indicators (Andreev et al., 2009, p. 5).

While reliability becomes an irrelevant criterion for assessing formative models (e.g., Diamantopoulos, 2006), the examination of validity becomes essential (Diamantopoulos & Siguaw, 2006; Götz et al., 2010; Henseler et al., 2009; Urbach & Ahlemann, 2010). Assessing formative constructs raises the concern of whether each indicator contributes to the formative construct (Henseler et al., 2009, p. 301). Various statistical tests can be performed to determine whether an indicator should be included in the formative construct or not (e.g., Diamantopoulos et al., 2008; Diamantopoulos & Winklhofer, 2001; Götz et al., 2010; Henseler et al., 2009; Urbach & Ahlemann, 2010), including: assessing the degree of multicollinearity, assessing indicators' weights, significance as well as loadings, and assessing indicators' validity.

Assessing the degree of multicollinearity among formative indicators is important in formative model validation, as high multicollinearity could mean that a formative indicator's information is redundant (Henseler et al., 2009). That is, the existence of multicollinearity may suggest that specification of the formative indicators was not performed successfully since formative indicators should represent distinct characteristics of the content domain and high covariance might mean that formative indicators explain the same aspect of the domain (Andreev et al., 2009, p: 6). In order to check for multicollinearity, variance inflation factor (VIF) was calculated (e.g., Götz et al., 2010; Henseler et al., 2009; Urbach & Ahlemann, 2010). A rule of thumb from econometrics states that VIFs greater than 10 reveal a critical level of multicollinearity (e.g., Diamantopoulos & Siguaw, 2006; Gefen et al., 2011; Götz et al., 2010; Henseler et al., 2009). While many researchers (e.g. Diamantopoulos & Siguaw, 2006; Gefen et al., 2011; Götz et al., 2010;) consider VIFs up to 10 acceptable. In this study all VIFs are less than 2.4, which strongly indicates that multicollinearity is not affecting the IS-Support data in this sample. Table 11 displays the results.

Table 11
VIF and tolerance values for the second-order formative IS-Support

Indicators	VIF
Training	2.066
Documentation	1.645
Assistance	2.392
Authorisation	1.218

In PLS, the significance of formative indicator weights can be determined by means of bootstrapping (e.g., Chin, 1998b; Götz et al., 2010; Henseler et al., 2009; Urbach & Ahlemann, 2010). However, formative indicator weights must not be interpreted as factor loadings (Götz et al., 2010, p. 698), but should be assessed and compared to determine their relative contribution to the formative construct (Henseler et al., 2009). Formative indicator weights explain the amount of variance in the formative construct that is explained by the indicator. Hence, a high indicator weight suggests that the indicator is making a substantive contribution to the formative construct (Diamantopoulos, 2006). As such, formative indicator weights are often smaller than the loadings of reflective indicators (Götz et al., 2010). A significance level of at least .050 suggests that an indicator is relevant for the construction of the formative construct and, thus, demonstrates a sufficient level of validity (e.g., Urbach & Ahlemann, 2010, p. 20). It is also recommended that the path coefficients (between formative indicators and their respective construct) should be greater than .100 (Andreev et al., 2009; Jahner et al., 2008) or .200 (Chin, 1998a).

The significance of formative indicators' weights can be determined by means of bootstrapping (e.g., Chin, 1998b, 2010; Götz et al., 2010; Henseler et al., 2009; Urbach & Ahlemann, 2010). Therefore, a bootstrap analysis was performed with 5000 subsamples and path coefficients were re-estimated using each of these samples. Results are presented in Table 12.

Table 12
Path coefficients, significance and loadings for the second-order formative IS-Support

Indicators	Path Weight	T-Value	P-Value	Loading
Training	0.237	18.37	$p < 0.001$	0.879
Documentation	0.611	29.39	$p < 0.001$	0.906
Assistance	0.263	24.02	$p < 0.001$	0.962
Authorisation	0.108	5.50	$p < 0.001$	0.743

As depicted in Table 12, all specified paths had significant and strong path coefficients. Also, all second-order formative indicators have high loading (i.e., zero-order bivariate correlation) on the IS-Support construct. This implies that all second-order formative indicators have a high relative and absolute effect on the IS-Support construct (Cenfetelli & Bassellier, 2009).

To assess the validity of the second-order formative indicators, they were correlated (using SPSS version 23) with *'global measures'* (i.e., criterion measures) that summarize the essence of the IS-Support construct. The two global measures used are: ***CM1:*** *Overall, ALESCO support is substantial, and* ***CM2:*** *Overall, ALESCO support is helpful.* Results in Table 13 show that these second-order formative indicators have high significant correlation, with the two global measures (CM1 and CM2) at 0.01 level, which confirms the indicators' validity.

Table 13
The second-order formative indicators correlations with the two global measures

Indicators	Correlations with CM1	Correlations with CM2
Training	.629**	.551**
Documentation	.587**	.601**
Assistance	.807**	.817**
Authorisation	.364**	.314**

** Correlation is significant at the 0.01 level (2-tailed)

5.2 Assessment at the Construct Level

Assessment at the construct level refers to the wider, out of the construct, validation of its measures (Straub et al., 2004). For instance, construct validity is concerned with whether or not indicators of the construct indeed measure what they intend to from the perspective of relationships between constructs, and between constructs and their relative indicators (Andreev et al., 2009, p. 6). In this study, construct validity of the IS-Support construct is assessed in terms of: (1) the nomological validity (e.g., Andreev, et al., 2009; Henseler et al., 2009; Urbach & Ahlemann, 2010), and (2) the external validity (e.g., Götz et al., 2010; Reinartz et al., 2004).

A nomological network includes a (i) theoretical framework of research objects, (ii) an empirical framework of how these objects will be measured, and (iii) specification of the relationships between these two frameworks (Campbell & Fiske, 1959). Assessing nomological validity involves evaluating the extent to which the formative construct behaves as expected within a net of hypotheses (Diamantopoulos & Winklhofer, 2001; Urbach & Ahlemann, 2010). Accordingly, those relationships between the formative construct and other of the structural model constructs, which have been sufficiently referred to in prior literature, should be strong and significant (Andreev et al., 2009; Diamantopoulos & Winklhofer, 2001; Urbach & Ahlemann, 2010). That is, testing the nomological validity of a formative construct involves (Andreev et al., 2009, p. 8): linking the focal construct with its hypothesized antecedents and consequence constructs, and evidencing nomological validity where the

hypothesized linkages (structural paths) between the constructs are found to be significantly greater than zero and their signs are in the expected causality direction.

The nomological validity of the IS-Support construct was tested by linking the IS-Support construct with the Satisfaction construct in the nomological net. Fig. 3 illustrates the results. The results show that the relationship between the constructs is strong (β = .598, p< .001) and significant (*t*-value = 12.08), which confirms the nomological validity of IS-Support construct. Also, R^2 for the Satisfaction construct of 35.8% signifies that much of the variance in "Satisfaction" could be explained by the formative measurement model (i.e., the IS-Support construct).

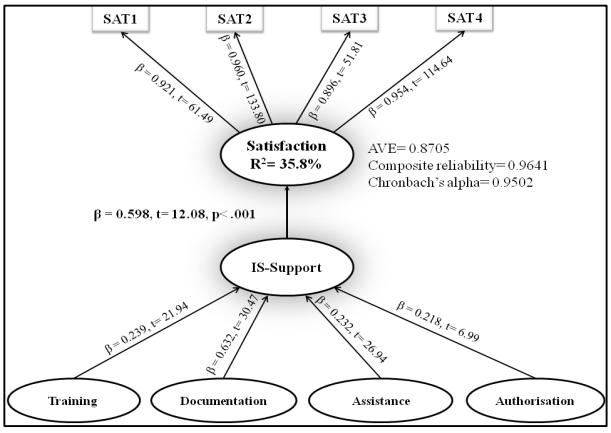

Fig. 3. Nomological validity of the IS-Support construct

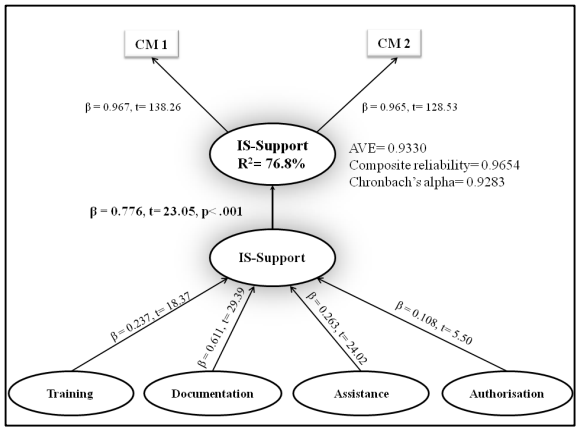

Fig. 4. External validity of the IS-Support construct

Testing the external validity for a formative measurement model is concerned with the extent to which the formative indicators actually capture the domain of the construct (Andreev et al., 2009; Chin, 1998b; Götz et al., 2010; Jahner et al., 2008; Reinartz et al., 2004). In assessing the external validity of a formative measurement model, one should be concerned about the construct's error-term ***v***, which represents the part of the construct that is not captured by any formative indicators (Götz et al., 2010). External validity can be assessed by means of regressing the formative construct on a reflective indicator of the same construct (Henseler et al., 2009), as it is often possible to operationalize a construct formatively as well as reflectively (Götz et al., 2010; Reinartz et al., 2004). In this case, reflective indicators can be used to measure the error terms (Götz et al., 2010, p. 699). In fact, the operationalization of a formative construct by means of reflective indicators allows the measurement error to be determined (Chin, 1998a).

A Multiple Indicators and Multiple Causes (MIMIC) model (Hauser & Goldberger, 1971; Jöreskog & Goldberger, 1975) might be applied for the model identification procedure (Andreev et al., 2009; Götz et al., 2010), where both formative and at least two reflective indicators measure one construct (Diamantopoulos et al., 2008; Diamantopoulos & Winklhofer, 2001). However, PLS does not allow the construction of a MIMIC model. An alternative specification for quantifying the error terms is to use the two-construct model that integrates an additional "phantom variable" (Götz, et al., 2010), which represents the construct's reflective operationalisation (Diamontopoulos & Winklhoffer, 2001). If a strong and significant association between the construct and the phantom variable is confirmed, external validity is proven (Götz, et al., 2010, p. 700).

In this study, a two-construct model, as suggested by Diamantopoulos and Winklhofer (2001) was employed to assess the external validity of the IS-Support construct. Figure 4 illustrates the results. The strong (β = .776, p< .001) and significant (*t*-value = 23.05) connection between the formative and the reflective measurement models of IS-Support verified its external validity. Also, R^2 for the reflective construct (i.e., the phantom variable) of 76.8% indicates that a significant part of the variance in "IS-Support" could be explained by the formative measurement model.

6. Discussion

In this study, the IS-Support model was conceptualized as a first-order reflective, second-order formative model, with four reflective dimensions, namely: Training, documentation, Assistance, and Authorisation- with 2, 5, 2, and 3 indicators respectively, totaling 12 reflective indicators.

Validity assessment of the IS-Support model started by assessing the first-order, reflective indicators. Training, Documentation, and Assistance dimensions are robust in terms of their internal consistency reliabilities as indexed by the composite reliability and Cronbach's alpha scores, which are well above 0.70 the recommended threshold value of 0.70 (Nunnally, 1978). The initial Authorisation dimension showed Composite Reliability of 0.7385 and a Cronbach's Alpha of 0.41, which were below the generally accepted level. Through dropping the lowest loading item, Auth3, from the Authorisation dimension and re-running the analysis iteratively, the Composite Reliability score improved to 0.9209 and the Cronbach's Alpha to 0.8292. Likewise, the loading for Auth1 increased from 0.8420 to 0.9112 and Auth2 from 0.8887 to 0.9362 (see Tables 6 and 7). After dropping Auth3, the IS-Support model consisted of 11 first-order reflective indicators. All four dimensions

demonstrate convergent validity with AVE values of (0.9688), (0.9098), (0.8972), and (0.8534) for Training, Documentation, Assistance and Authorisation respectively (see Table 8). Moreover, all 11 indicators have shown high inter-correlations (see Table 9), and high and significant loadings on their respective LV, low cross loadings on other reflective LVs in the model (see Table 10) confirming the discriminant validity on the indicators as well as the LV levels.

To assess the second-order formative IS-Support construct, linear composites from the indicators were created and used as formative indicators for the second-order construct. The second-order construct was assessed in terms of the degree of multi-collinearity, where VIF scores were less than 2.4 (see Table 11). All second-order formative indicators have shown high weight, significant T-value, and high loadings (see Table 12). Moreover, all second-order formative indicators have high and significant correlation with the two global measures that summarize the essence of the IS-Support construct (see Table 13), confirming the second-order indicators' validity. The nomological validity of IS-Support was tested by connecting the IS-Support model with the Satisfaction construct in the nomological net (see Fig. 3). Results confirm the nomological validity of the IS-Support model by (1) the strong ($\beta = .598$, $p < .001$) and significant (t-value = 12.08) connection between the IS-Support and Satisfaction, and (2) R^2 value for the Satisfaction construct, of 35.8%, signifies that much of the variance in Satisfaction could be explained by the IS-Support measurement model. The external validity of the IS-Support model was verified through the use of a two-construct model (see Fig. 4), where (1) the strong ($\beta = .776$, $p < .001$) and significant (t-value= 23.05) connection between the formative and the reflective measurement models of IS-Support were demonstrated, and (2) R^2 value for the reflective phantom variable, of 76.8%, indicates that a significant part of the variance in IS-Support could be explained by the formative IS-Support measurement model. Figure 5 presents the validated IS-Support model based on the findings of this study.

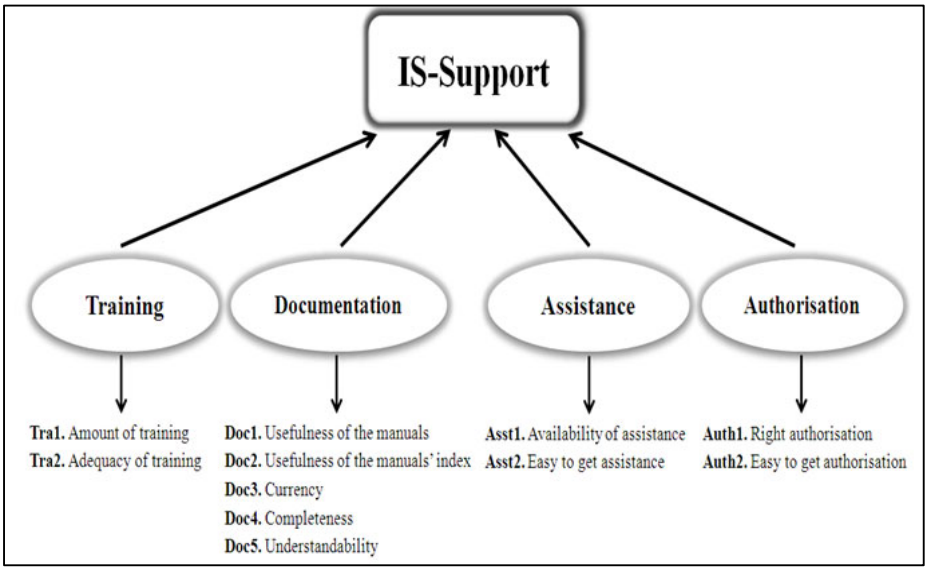

Fig. 5. The validated IS-Support model

Finally, with the main objective of assessing the nomological validity, the Satisfaction construct was conceptualised as an immediate consequance of both IS-Support and IS-Impact models. The Satisfaction construct was conceptualized reflectively with four indicators: "frustrated/contented", "displeased/pleased", "terrible/delighted", and "dissatisfied/satisfied". The Satisfaction construct demonstrates high internal consistency with a Cronbach's alpha value of (0.9502) and composite reliability value of (0.9641) (see Table 6). Also, an AVE value of (0.8705) confirms the convergent validity of the Satisfaction construct (see Table 8). Additionally, all four indicators have shown high inter-correlations (see Table 9), and high and significant loadings on the Satisfaction construct, low cross loadings on other reflective LVs in the model (see Table 10), confirming the discriminant validity of the Satisfaction construct at both the indicators as well as the LV levels.

7. Conclusion, Limitations and Future Research

This study conceptualized and validated a new IS-Support construct as a first-order reflective, second order formative multi-dimensional construct, with 11 reflective indicators organized in 4 reflective dimensions. The validated IS-Support model, in conjunction with the applied data analysis procedures in this study, provides a valuable reference point for a wide range of empirical studies that could be conducted to further test this model, extending this model, applying this model in similar or different research domains/settings, or testing different conceptualizations of the same model. For instance, through insights into the validity of the models; with the complexity of evaluating IS in general, this study can be a strong backbone of knowledge to guide future empirical research concerned with evaluating IS support in a holistic way. Also, this study provides empirical evidence for conceiving Satisfaction as an immediate consequence of IS-Support which in turns extends other related research work. This study has also made noteworthy methodological contributions by following a rigorous and innovative approach for analyzing complex multidimensional constructs with both reflective and formative indicators.

The rigorously validated IS-Support instrument proposed in this study can help organizations to evaluate the Support information system key-user groups receive to increase their capabilities in utilizing the system. As the findings of this study demonstrate that IS-Support is an important aspect that contributes to users' Satisfaction with the IS, practitioners should recognize and pay close attention to the support provided to IS users, as the benefits realized from the large investments in IS are being much influenced by the support provided to IS users and their satisfaction with the system (Shaw, et al., 2002; Shaw, et al., 2003; Wixom & Todd, 2005). Moreover, the IS-Support model consists of multiple dimensions and measures, with a set of 11 measures organized in 4 dimensions, each of which represents different and unique aspects of IS-Support. While the findings of this study indicated that each dimension and measure have a different contribution power, when measuring the support of an IS application, practitioners should employ the complete set of measures to arrive at holistic scores of the IS-Support phenomena. Finally, the IS-Support instrument is complete, simple, easy to administer, easy to understand and used by different types of key-user groups within the organization.

While there are many contributions of this study, there are also a number of limitations, as in any research. The data collection was constrained to only one organization and one IS application - ALESCO. This imposes a limitation on the generalizability of the findings. Thus, future research should validate the IS-Support model in a different context with different IS applications. Additionally, this study adopted a positivist theoretical assumption, given the objective of this research, which seeks to test and validate the IS-Support model. Future research should adopt other theoretical perspectives such as critical realism, interpretivism, or a combination of multiple theoretical perspectives. Finally, this study employed survey research methodology. It is suggested that future work can incorporate different research methods such as semi-structured interviews, grounded theory, experiments or focus groups.

References

Ali, A., Tate, M., Rabaa'i, A., & Zhang, M. (2012). A critical evaluation and comparison of two formative measures of system quality using criterion variables. *In 23rd Australasian Conference on Information Systems*.

Andreev, P., Heart, T., Maoz, H., & Pliskin, N. (2009). Validating Formative Partial Least Squares (PLS) Models: Methodological Review and Empirical Illustration. *In 13th International Conference on Information Systems (ICIS).*

Armstrong, J. S., & Overton, T. S. (1977). Estimating Non-Response Bias in Mail Surveys. *Journal of Marketing Research, 14*(8), 396-402.

Au, N., Ngai, E. W. T., & Cheng, T. C. E. (2008). Extending the understanding of end user information systems satisfaction formation: An equitable needs fulfillment model approach. *MIS Quarterly, 32*(1), 43-66.

Au, N., Ngaib, E., & Chengb, E. (2002). A critical review of end-user information system satisfaction research and a new research framework. *Omega, 30*, 451 - 478.

Bailey, E., & Pearson, W. (1983). Development of a tool for measuring and analyzing computer user satisfaction. *Management Science, 29*(5), 530-545.

Baroudi, J., & Orlikowski, J. (1988). A short-form measure of user information satisfaction: A psychometric evaluation of notes on use. *Journal of Management lnformation Systems, 4*(4), 44-59.

Bergersen, B. (2004). User Satisfaction and Influencing Issues. *Network and System Administration Research Surveys, 1*, 5-26.

Bhattacherjee, A. (2001). Understanding Information Systems Continuance: An Expectation-Confirmation Model. *MIS Quarterly, 25*(3), 351-370.

Boudreau, M.-C., Gefen, D., & Straub, D. W. (2001). Validation in Information Systems Research: A State-of-the-Art Assessment. *MIS Quarterly, 25*(1), 1-16.

Briggs, R. O., Reinig, B. A., & de Vreede, G.-J. (2008). The Yield Shift Theory of Satisfaction and Its Application to the IS/IT Domain. *Journal of the Association for Information Systems, 9*(5), 267-293.

Burton-Jones, A., & Straub, D. W. (2006). Reconceptualizing System Usage: An Approach and Empirical Test. *Information Systems Research, 17*(3), 228-246.

Campbell, D. T., & Fiske, D. W. (1959). Convergent and discriminant validation by the multitrait-multimethod matrix. *Psychological Bulletin, 56*(2), 81-105.

Carlson, W., & McNurlin, B. (1992). Basic Principles for Measuring IT Value. *I/S Analyzer, 30*(10), 1-16.

Carmines, E. G., & Zeller, R. A. (1979). *Reliability and validity assessment*. Beverly Hills, California: Sage Publications.

Cenfetelli, R. T., & Bassellier, G. (2009). Interpretation of Formative Measurement in Informations Systems Research. *MIS Quarterly, 33*(4), 689-707.

Cenfetelli, R. T., Benbasat, I., & Al-Natour, S. (2008). Addressing the What and How of Online Services: Positioning Supporting-Services Functionality and Service Quality for Business-to-Consumer Success. *Information Systems Research, 19*(2), 161-181.

Chang, J., & King, W. (2005). Measuring the Performance of Information Systems: A Functional Scorecard. *Journal of Management Information Systems, 22*(1), 85-115

Cheng, E., & Ngai, T. (1994). Management support systems for service quality management: A research direction. *International Journal for Quality and Reliability Management, 11*(8), 44-56.

Chin, W. (1998a). Issues and opinion on structural equation modeling. *MIS Quarterly, 22*(1), 7-16.

Chin, W. (1998b). *The partial least squares approach to structural equation modeling. In G. A. Marcoulides (Ed.), Modern Methods for Business Research (pp. 295-358).* Mahwah, NJ: Lawrence Erlbaum Associates.

Chin, W. (2010). Bootstrap Cross-validation Indices for PLS Path Model Assessment. In V. E. Vinzi, H. Wang, J. Henseler & W. Chin (Eds.), Handbook of partial least squares: Concepts, methods and applications in marketing and related fields. Heidelberg: Springer.

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika, 16*(3), 297-334.

Delone, H. (1988). Determinants of success for computer usage in small business. *MIS Quarterly, 12*(1), 51-61.

Delone, H., & Mclean, E. (2003). The DeLone and McLean Model of Information Systems Success: A Ten-Year Update. *Journal of Management Information Systems, 19*(4), 3-30.

DeLone, W. H., & McLean, E. R. (1992). Information systems success: The quest for the dependent variable. *Information Systems Research, 3*(1), 60-95.

Diamantopoulos, A. (2006). The error term in formative measurement models: Interpretation and modeling implications. *Journal of Modelling in Management, 1*(1), 7-17.

Diamantopoulos, A., & Siguaw, J. A. (2006). Formative Versus Reflective Indicators in Organizational Measure Development: A Comparison and Empirical Illustration. *British Journal of Management 17*(4), 263-282.

Diamantopoulos, A., & Winklhofer, H. M. (2001). Index Construction with Formative Indicators: An Alternative to Scale Development. *Journal of Marketing Research, 38*(2), 269-277.

Diamantopoulos, A., Riefler, P., & Roth, K. P. (2008). Advancing formative measurement models. *Journal of Business Research, 61*(12), 1203-1218.

Doll, W. J., & Torkzadeh, G. (1988). The Measure of End-User Computing Satisfaction. *MIS Quarterly, 12*(2), 259-274.

Etezadi-Amoli, J., & Farhoomand, A. F. (1996). A structural model of end user computing satisfaction and user performance. *Information & Management, 30*(2), 65-73.

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research, 18*(1), 39-50.

Gable, G., & Sedera, D. (2009). Formative and reflective measurement and validation mismatch in survey research : an archival analysis of information systems success constructs 1985-2007. Paper presented at the Thirtieth International Conference on Information Systems, Phoenix, Arizona: USA.

Gable, G., Sedera, D., & Chan, T. (2008). Re-conceptualizing Information System Success: The ISImpact Measurement Model. *Journal of the Association for Information Systems, 9*(7), 377-408.

Galletta, F., & Lederer, S. (1989). Some cautions on the measurement of user information satisfaction. *Decision Sciences, 20*(3), 419-439.

Gefen, D., Rigdon, E., & Straub, D. (2011). EDITOR'S COMMENTS: An Update and Extension to SEM Guidelines for Administrative and Social Science Research. *MIS Quarterly, 35*(2), iii-xiv.

Goodhue, D. (1995). Understanding User Evaluations of Information Systems. *Management Science, 41*(12), 1827-1844.

Götz, O., Liehr-Gobbers, K., & Krafft, M. (2010). Evaluation of structural equation models using the partial least squares (PLS) approach. In V. Esposito Vinzi, H. Wang, J. Henseler & W. W. Chin (Eds.), Handbook of partial least squares: Concepts, methods and applications in marketing and related fields. Heidelberg: Springer.

Gregor, S. (2006). The nature of theory in information systems. *MIS Quarterly, 30*(3), 611-642.

Hair, J. F., Hollingsworth, C., Randolph, A., & Chong, A. (2017). An updated and expanded assessment of PLS-SEM in information systems research. *Industrial Management & Data Systems, 117*(3), 442–458. https://doi.org/10.1108/IMDS-04-2016-0130

Hair, J. F., Sarstedt, M., Hopkins, L., & G. Kuppelwieser, V. (2014). Partial least squares structural equation modeling (PLS-SEM): An emerging tool in business research. *European Business Review, 26*(2), 106–121. https://doi.org/10.1108/EBR-10-2013-0128

Hammouri, Q., Altaher, A., Al-Gasawneh, J., Rabaa'i, A., Aloqool, A., and Khataybeh, H. (2022). Understanding the Determinants of Digital Shopping Features: The Role of Promo Code on Customer Behavioral Intention. *International Journal of Data and Network Science, 6*(3), 641-650.

Hauser, R. M., & Goldberger, A. S. (1971). *The treatment of unobservable variables in path analysis*. In H. L. Costner (Ed.), Sociological Methodology (pp. 81-117). London: Jossey-Bass.

Henseler, J., Ringle, C. M., & Sinkovics, R. R. (2009). The use of partial least squares path modeling in international marketing. *Advances in International Marketing, 20*, 277-320.

Igbaria, M., & Tan, M. (1997). The Consequences of Information Technology Acceptance on Subsequent Individual Performance. *Information and Management, 32*(3), 113-121.

Iivari, J. (1987). User information satisfaction (UIS) reconsidered: An information system as the antecedent of UIS. *Paper presented at the Eighth International Conference on Information Systems.*

Ives, B., Olson, H., & Baroudi, J. (1983). The measurement of user information satisfaction. *Communications of the ACM, 26*(10), 785-793.

Jahner, S., Leimeister, J. M., Knebel, U., & Krcmar, H. (2008). A Cross-Cultural Comparison of Perceived Strategic Importance of RFID for CIOs in Germany and Italy. In I. C. Society (Ed.), *41st Annual Hawaii International Conference on System Sciences*.

Jarvis, C. B., MacKenzie, S. B., & Podsakoff, P. M. (2003). A Critical Review of Construct Indicators and Measurement Model Misspecification in Marketing and Consumer Research. *Journal of Consumer Research, 30*(2), 199-218.

Jiang, J., J., Klein, G., & Carr, C. (2002). Measuring information system service quality: SERVQUAL from the other side. *MIS Quarterly, 26*(2), 145-166.

Jöreskog, K., & Goldberger, A. S. (1975). Estimation of a Model with Multiple Indicators and Multiple Causes of a Single Latent Variable. *Journal of the American Statistical Association, 70*, 631-639.

Joshi, K. (1990). An investigation of equity as a determinant of user information satisfaction. *Decision Sciences, 21*(4), 786-807

Karimi, J., Somers, M., & Gupta, P. (2004). Impact of Environmental Uncertainty and Task Characteristics on User Satisfaction with Data. *Information Systems Research, 15*(2), 175-193.

Kettinger, W., & Lee, C. (1994). Perceived Service Quality and User Satisfaction with the Information Services Function. *Decision Sciences, 25*(5/6), 737-766.

Khalifa, M., & Liu, V. (2004). The State of Research on Information System Satisfaction. *Journal of Information Technology Theory and Application, 5*(4).

Klenke, K. (1992). Construct measurement in management information systems: A review and critique of user satisfaction and user involvement instruments. *Information & Management, 30*(4), 325-348.

Kositanurit, B., Ngwenyama, O., & Osei-Bryson, K.-M. (2006). An exploration of factors that impact individual performance in an ERP environment: an analysis using multiple analytical techniques. *European Journal of Information Systems, 15*, 556–568.

Lewis, B. R., Templeton, G. F., & Byrd, T. A. (2005). A methodology for construct development in MIS research. *European Journal of Information Systems, 14*(4), 388-400.

MacCallum, R. C., & Browne, M. W. (1993). The use of causal indicators in covariance structure models: Some practical issues. *Psychological Bulletin, 114*, 533-541.

MacKenzie, S. B., Podsakoff, P. M., & Podsakoff, N. P. (2011). Construct measurement and validation procedures in MIS and behavioral research: Integrating new and existing techniques. *MIS Quarterly, 35*(2), 293-334.

Melone, A. (1990). Theoretical assessment of the user-satisfaction construct in information systems research. *Management Science, 36*(1), 76-91.

Moore, G. C., & Benbasat, I. (1991). Development of an Instrument to Measure the Perceptions of Adopting an Information Technology Innovation. *Information Systems Research, 2*(3), 192-222.

Munkvold, R. (2003). *End User Support Usage. In S. Gordon (Ed.), Computing information technology: the human side. Hershey PA: IRM Press*.

Myers, B. L., Kappelman, L. A., & Prybutok, V. R. (1998). A comprehensive model for assessing the quality and productivity of the information systems function: toward a theory for information systems assessment. In E. J. Garrity & G. L. Sanders (Eds.), Information Systems Success Measurement (pp. 94 - 121). Hershey: PA IGI Publishing.

Palvia, P. C. (1996). A model and instrument for measuring small business user satisfaction with information technology. *Information & Management, 31*(3), 151-163.

Nunnally, C., & Bernstein, H. (1994). *Psychometric Theory* (3rd ed.). McGrawHill.

Nunnally, J. (1978). *Psychometric Theory*. New York: McGraw-Hill.

Oliver, R. (1997). *Satisfaction: A Behavioral Perspective on the Consumer*. New York: McGraw Hill.

Oliver, R., & Swan, J. (1989). Consumer perceptions of interpersonal equity and satisfaction in transactions: a field survey approach. *Journal of Marketing, 53*, 21-35.

Parasuraman, A., Berry, L., & Zeithaml, V. (1991). Refinement and Reassessment of Service Quality. *Journal of Retailing, 64*(1), 12-40

Parasuraman, A., Zeithaml, V. A., & Berry, L. (1993). More on Improving the Measurement of Service Quality. *Journal of Retailing, 69*(1), 140-147.

Petter, S., DeLone, W., & McLean, E. (2008). Measring information systems success: Models, dimensions, measures, and interrelationships. *European Journal of Information Systems, 17*, 236-263

Petter, S., Straub, D., & Rai, A. (2007). Specifying Formative Constructs in Information systems research. *MIS Quarterly, 31*(4), 623-656.

Pitt, F., Watson, R., & Kavan, C. (1997). Measuring Information Service Quality: Concerns for a Complete Canvas. *MIS Quarterly, 21*(2), 209-222.

Polites, G. L., Roberts, N., & Thatcher, J. (2011). Conceptualizing models using multidimensional constructs: a review and guidelines for their use. *European Journal of Information Systems, 20*(1), 1-27.

Rabaa'i, A. A. (2010). Cultural influences on IS service quality perceptions. In 21st Australasian Conference on Information Systems: Defining and Establishing a High Impact Discipline (ACIS).

Rabaa'i, A. A. (2012). Evaluating the success of large-scale, integrated information systems through the lens of IS-impact and IS-support. [PhD thesis]. Queensland University of Technology

Rabaa'i, A. A. (2015a). An Empirical Investigation on the Adoption of e-Government in Developing Countries: The Case of Jordan. *Computer and Information Science, 8*(3), 83. https://doi.org/10.5539/cis.v8n3p83

Rabaa'i, A. A. (2015b). Conceptualising IS-service quality as a multi-dimensional formative construct: an empirical analysis. *International Journal of Information Systems and Management, 1*(3), 240–263.

Rabaa'i, A. A. (2016). Extending the technology acceptance model (TAM) to assess students' behavioural intentions to adopt an e-learning system: The case of moodle as a learning tool. *Journal of Emerging Trends in Engineering and Applied Sciences, 7*(1), 13–30.

Rabaa'i, A. A. (2017a). Holistic Procedures for Contemporary Formative Construct Validation Using PLS: A Comprehensive Example. *International Journal of Business Information Systems, 25*(3), 279–318. https://doi.org/10.1504/IJBIS.2017.084436

Rabaa'i, A. A. (2017b). The use of UTAUT to investigate the adoption of e-government in Jordan: A cultural perspective. *International Journal of Business Information Systems, 24*(3), 285–315. https://doi.org/10.1504/IJBIS.2017.082037

Rabaa'i, A. A. (2022). What's for Dinner? Factors Contributing to the Continuous Usage of Food Delivery Apps (FDAs). *Asia Pacific Journal of Information Systems*.

Rabaa'i, A. A. (in press a). An Investigation into the acceptance of mobile wallets in the FinTech era: an empirical study from Kuwait. *International Journal of Business Information Systems*. DOI: 10.1504/IJBIS.2021.10038422

Rabaa'i, A. A. (in press b). Factors affecting the adoption of mobile grocery delivery applications. *International Journal of Business Information Systems*. DOI: 10.1504/IJBIS.2021.10045250

Rabaa'i, A. A. and Gammack, J. G. (2014). Effect of culture on perceptions of IS service quality. *International Journal of Intercultural Information Management, 4*(1), 15–33.

Rabaa'i, A. A., & Abu ALMaati, S. (2021). Exploring the Determinants of Users' Continuance Intention to Use Mobile Banking Services in Kuwait: Extending the Expectation-Confirmation Model. *Asia Pacific Journal of Information Systems, 3*, 141–184. https://doi.org/10.14329/apjis.2021.31.2.141

Rabaa'i, A. A., & Gable, G. (2012). IS service quality as a multi-dimensional formative construct. *In 16th Pacific Asia Conference on Information Systems*

Rabaa'i, A. A., & Zhu, X. (2021). Understanding the Determinants of Wearable Payment Adoption: An Empirical Study. *Interdisciplinary Journal of Information, Knowledge, and Management, 16*, 173–211. https://doi.org/10.28945/4746

Rabaa'i, A. A., Al-lozi, E., Hammouri, Q., Bany Muhammad, N., Alsmadi, A. and Al-Gasawneh, J. (2022). Continuance Intention to Use Smartwatches: An Empirical Study. *International Journal of Data and Network Science*. DOI: 10.5267/j.ijdns.2022.4.012

Rabaa'i, A. A., ALmaati, S. A., & Zhu, X. (2021). Students' Continuance Intention to Use Moodle: An Expectation-Confirmation Model Approach. *Interdisciplinary Journal of Information, Knowledge, and Management, 16*, 397–434. https://doi.org/10.28945/4842

Rabaa'i, A. A., Bhat, H., & Abu Al Maati, S. (2018). Theorising social networks addiction: An empirical investigation. *International Journal of Social Media and Interactive Learning Environments, 6*(1), 1. https://doi.org/10.1504/IJSMILE.2018.10013518

Rabaa'i, A. A., Gable, G. G., Bandara, W., & Fielt, E. (2010). Re-conceptualising IS function's support performance: a preliminary model. *In 14th Pacific Asia Conference on Information Systems* (PACIS, 9-12 July)

Rabaa'i, A. A., Tate, M., & Gable, G. (2015). Can't See the Trees for the Forest? Why IS-ServQual Items Matter. *Asia Pacific Journal of Information Systems, 25*(2), 211-238.

Rabaai, A. A., Zogheib, B., AlShatti, A., & AlJamal, E. M. (2015). Adoption of E-Government in Developing Countries: The Case of the State of Kuwait. *Journal of Global Research in Computer Science, 6*(10), 6–21.

Reinartz, W., Krafft, M., & Hoyer, W. D. (2004). The customer relationship management process: Its measurement and impact on performance. *Journal of Marketing Research, 41*(3), 293-305.

Ringle, C., Sarstedt, M., & Straub, D. (2012). Editor's Comments: A Critical Look at the Use of PLS-SEM in MIS Quarterly. *MIS Quarterly, 36*(1), 3-14.

Ringle, C., Wende, S., & Becker, J. (2015). SmartPLS 3. Boenningstedt: SmartPLS GmbH. http://www.smartpls.com

Rockart, F., & Flannery, S. (1983). The management of end user computing. Communications of the ACM, 26(10), 776-784.

Ross, P. K. (2011). How to keep your head above the clouds: Changing ICT worker skill sets in a cloud computing environment. *Employment Relations Record, 11*(1), 62-74.

Saunders, C. S., & Jones, J. W. (1992). Measuring Performance of the Information Systems Function. *Journal of Management Information Systems, 8*(4), 63-82.

Seddon, P. B., Calvert, C., & Yang, S. (2010). A multi-project model of key factors affecting organizational benefits from enterprise systems. *MIS Quarterly, 34*(2), 305-328.

Shaw, N., DeLone, W., & Niederman, F. (2002). Sources of dissatisfaction in End User Support: An Empirical Study. *The DATA BASE for Advances in Information Systems, 33*(2), 41-56.

Shaw, N., Lee-Partidge, J., & Ang, J. (2003). Understanding the hidden dissatisfaction of users toward end-user computing. *Journal of End User Computing, 15*(2), 1-22.

Shin, B. (2003). An Exploratory Investigation of System Success Factors in Data Warehousing. *Journal of the Association for Information Systems, 4*, 141-170.

Sivo, S. A., Saunders, C., Chang, Q., & Jiang, J. (2006). How Low Should You Go? Low Response Rate and the Validity of Inference in IS Questionnaire Research. *Journal of the Association for Information Systems, 7*(6), 351-414.

Spreng, R., MacKenzie, S., & Olshavsky, R. (1996). A Reexamination of the Determinants of Consumer Satisfaction. *Journal of Marketing Research, 60*(3), 15-32.

Stevens, J. P. (2001). *Applied Multivariate Statistics for the Social Sciences* (4 ed.). Hillsdale, New Jersey: Lawrence Erlbaum Associates.

Straub, D. W. (1989). Validating instruments in MIS research. *MIS Quarterly, 13*(2), 147-169.

Tate, M., & Evermann, J. (2010). The End of ServQual in Online Services Research: Where to from here? *e-Service Journal, 7*(1), 60-85.

Urbach, N., & Ahlemann, F. (2010). Structural Equation Modeling in Information Systems Research Using Partial Least Squares. *Journal of Information Technology Theory and Application, 11*(2), 5-40.

Van Dyke, T. P., Kappelman, L. A., & Prybutok, V. R. (1997). Measuring Information Systems Service Quality: Concerns on the Use of the SERVQUAL Questionnaire. *MIS Quarterly, 21*(2), 195-208.

VanDyke, T., Prybutok, V., & Kappelman, L. (1999). Cautions on the use of the SERVQUAL measure to assess the quality of information systems services. *Decision Sciences, 30*(30), 877-891.

Velsen, L. S. V., Steehouder, M. F., & Jong, M. D. T. D. (2007). Evaluation of User Support: Factors That Affect User Satisfaction with Helpdesks and Helplines. *IEEE Transactions on Professional Communication, 50*(3), 219-231.

Vlachos, P. A., & Theotokis, A. (2009). Electronic Service Quality in Mobile Music Services: Comparing Different Second-Order Measurement Specification. In A. Poulymenakou, N. Pouloudi & K. Pramatari (Eds.), *4th Mediterranean Conference on Information Systems. Athens, Greece*.

Watson, R., Pitt, L., & Kavan, B. (1998). Measuring Information Systems Service Quality: Lessons from Two Longitudinal Case Studies. *MIS Quarterly, 22*(1), 61-79.

Werts, C. E., Linn, R. L., & Jöreskog, K. G. (1974). Intraclass reliability estimates: Testing structural assumptions. *Educational and Psychological Measurement, 34*(1), 25-33.

Wetzels, M., Odekerken-Schröder, G., & van Oppen, C. (2009). Using PLS path modeling for assessing hierarchical construct models: guidelines and empirical illustration. *MIS Quarterly, 33*(1), 177-195.

Wixom, B. H., & Todd, P. A. (2005). A Theoretical Integration of User Satisfaction and Technology Acceptance. *Information Systems Research, 16*(1), 85-102.

Yoo, Y., & Alavi, M. (2001). Media and Group Cohesion: Relative Influences on Social Presence, Task Participation, and Group Consensus. *MIS Quarterly, 25*(3), 371-390.

Zmud, W. (1984). Design alternatives for organizing information systems activities. *MIS Quarterly, 8*(2), 79-93.

Zogheib, B., Rabaa'i, A., Zogheib, S., & Elsaheli, A. (2015). University Student Perceptions of Technology Use in Mathematics Learning. *Journal of Information Technology Education: Research, 14*, 417–438. https://doi.org/10.28945/2315

Zviran, M., & Erlich, Z. (2003). Measuring IS User Satisfaction: Review and Implications. *Communications of the Association for Information Systems, 12*(1), 81-103.