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Change Management Model for Effective Use of Examination Administration System: Developing Country Case Study

Ngoanamosadi Stanford Mphahlele[1], Raymond Mompoloki Kekwaletswe[2], Tshinakaho Relebogile Seaba[3]

[1,3] Department of Informatics, Tshwane University of Technology, Pretoria, South Africa
[2] School of Management, University of Johannesburg, Johannesburg, South Africa
Email: [1]mphahlele.stanford@gmail.com, [2]raymondk@uj.ac.za, [3]seabatr@tut.ac.za

Abstract

There is inadequate knowledge on change management model (CMM) for post-acceptance phase of information systems. This paper intends to determine and model change management factors (CMFs) that explain effective use of Examination Administration System (EAS) in South Africa. A survey was used to collect data from 215 EAS users in Technical and Vocational Education and Training colleges and was analyzed quantitatively. Empirical results evince existence of casual nexuses between user involvement and change recognition, user satisfaction, performance measurement with use of EAS which through EAS adaptive use (EAU) in turn together with EAS verification, user learning representational fidelity and informed actions influence effective use of EAS. This study results add to literature by explaining the indirect mechanisms (i.e., EAS and EAU) through which the CMFs can influence effective use. This paper also offers a novel integration of Effective Use Theory and Unified Theory of Acceptance and Use of Technology with three CMFs which provides a holistic model. This study recommends that various communities endeavour to use CMM as a guide to influence user communities to effectively use information systems in diverse contexts. The model also has potential to drive improved return on investments and enhance employees' productivity.

Keywords: Examination Administration System, Change management factors, Effective Use Theory, Unified Theory of Acceptance and Use of Technology

1. INTRODUCTION

Over the past decade, the effective use behaviour has drawn the interest of information systems researchers. The challenge of using information systems ineffectively or only partially is known in the information systems scholar cycle as Recker et al. [1] acknowledged that as the information systems evolves the key issue is to ensure that IS are used effectively which remains a challenge to date. South African Technical and Vocational Education and Training (TVET) colleges have invested huge monies on Examinations Administration System (EAS) but there is still partial or lack of use of these systems. Simply put there is little knowledge in knowing what factors influence effective use of EAS.

This study intends to develop and validate a change management model (CMM) for effective use of information systems, specifically the EAS in South African TVET colleges. Apart from offering CMM for effective use in information systems, TVET colleges' decision makers may benefit from the CMM by identifying areas of improvement and to develop target intervention strategies.

This study relies on the integration of change management framework, Unified Theory of Acceptance and Use of Technology (UTAUT) [2] and Effective Use Theory [3] dimensions as a theoretical framework. The change management dimensions include such as top management support/guiding team and activities, user involvement and change recognition, change shared vision, planning a EAS as a change, effective communication, user training, user satisfaction, information flow and performance measurement harvested from the[4], [5], [6], [7], [8], [9], [10], [11], [12]. The change management dimensions are regarded as facilitating conditions of the technology use [2]. Yusif et al. [7] study unveiled that the introduction of information systems as change in health public organization in Ghana was influenced by change management factors (CMFs) influence. In context of this study, the use of EAS represents a change in TVET colleges in South Africa and this study argues that these change management strategies will influence effective use behaviour. Effective use is made of three dimensions (i.e., representational fidelity, transparent interaction and informed action), and three sub-dimensions (i.e., verification, adaptation and learning) [3], [13] hence the inclusion of these dimensions to evaluate the effective use of EAS. The change management dimensions from literature [8], [9], [14], [15], [16] have not been modelled and validated in the effective use (post-adoption- phase) of EAS context.

The aim of this paper is to model the change management, the commonly used change management definition is a structured approach to carry out the implementation of new processes that accept changes by individuals [17], [18]. In this study, change management refers to a set of programmes, processes, activities, techniques and structured approaches (tools), required to manage the user community to use the EAS. The Effective Use Theory refers to effective use as a degree to which the information systems user communities believe that the way they make use of information systems, helps them to carry out their activities (e.g. examinations administration) to produce desired results [3], [19].

This study also aims to validate the CMM. Literature uncovers limited knowledge on change management dimensions for the effective use (post-implementation phase) of information systems [20]. Mogogole and Jokonya [8] and Abatan and Maharaj [9] studies offered change management dimensions for the implementation of information and communications technologies projects. However, there is existence of literature on the usage of information systems in context of business intelligence [19], in the Chinese health care context [21]; usage of enterprise financial system in the Australia large tertiary education provider [21];

and use of information systems in general [3]. Yet, it seems change management dimensions, technology use and sub-dimension (i.e., verification of information systems) for effective use have been inadequately covered in papers reviewed in this study.

It is also important to highlight that the previous studies on effective use [19], [21], [22], [23] however there is no study that validated the verification and adaptive use activities in one study despite Burton-Jones & Grange [3], [13] recommending the incorporation of them as they play a crucial part in the implementation of the information systems success. There is also no study of the effective use specifically in the EAS context.

The challenge is the effective use of EAS has not been sufficiently covered in the literature. There is inadequate literature on use of EAS specifically in the South African TVET college settings. Therefore there is a need to develop integrated type-iv IS theory "Change management model for the effective use of EAS". From the articles identified in this paper there is no study that investigated how the CMFs can influence the effective use outcome which begins with individuals understanding their adoption of change (technology use outcome) [9]. Because TVET colleges' examinations administration and enquiry processes are now being carried on the EAS which represent a change. The incorporation of change management activities (factors) in the use and Effective Use Theory is warranted.

It is also important to investigate and validate these sub-dimensions of the effective use for EAS as suggested by Burton-Jones and Grange [3]. Information systems is a technology of some kind which refers to the sociotechnical, organizational systems that are utilized to gather, process, store, extract and distribute information in an institution [24]. Tantua and Godwin-Biragbara [25] refer to the operational type of IS, management information system as a set of hard/software, data, process and human components that cooperate to make it easier to carry out informating chain in order to transform raw data into useful information to support organization operational activities, management and decision making. A denominator from all the perspectives of an information systems is that there is an information processing/ informating chain that includes inputs, processing, output, and data storage. The EAS refers to a specialized customized-business function information systems that end user communities at different organizational levels (e.g. operational and management) have to use to perform their day-to-day operations such as facilitating the examinations administration to the society [26].

Public and private TVET colleges were established in terms of the Further Education and Training (FET) colleges Act No. 16 of 2006. Currently there are 183 in South Africa (50 public and 133 private colleges) [27], [28]. TVET colleges

(previously known as FET colleges) are one of the three tiers of higher education institutions alongside universities in South Africa , which provide programme-based vocational and occupational training to the members of public in SA and neighbouring countries such as Swaziland and Namibia. What makes SA a captivating case for this study is South Africa is a league leader in e-Government development in Africa, with an e-Government Development Index value of 0.7357 [29]. From this reasoning, effective use of EAS in South African TVET colleges is an ideal setting for this study. The rest of the study is organized as follows: methods (i.e., literature review, research model, constructs and hypotheses and procedures), results and discussions and conclusion.

2. METHODS

This section discusses literature review, research model, construct and development of hypotheses and research procedure.

2.1. Literature Review

This section discusses literature review on the CMM, effective use, specifically for EAS and concludes the change management framework, the UTAUT and the Effective Use Theory as theoretical framework.

2.1.1. Change Management Models

The examination administration processes in TVET colleges were digitized and transformed as manual handling processes are often slow and often lead to service delivery challenges in institutions of higher learning [30]. In this study, the use of EAS represents a change. Musungwini and Mono [6] regard a change as a new system, introducing a new system. In this papers, how the examinations administration is carried out in TVET colleges represent a change, a new system. The change is a standard situation especially when an organization introduces the application of new information or information systems is often accompanied by changes in operational processes, organizational structure and mechanisms of service delivery [5].

The information systems implementation life cycle involves pre-implementation, implementation, post-implementation phases [31], [32]. The focus of this study is the development and validation change management model for effective use of EAS which in post-acceptance phase. The post-acceptance phase of information systems involves the change management, top management support, project management, implementation team and user training [20]. Finney and Corbett [33] study posit reported that the change management has emerged as one of the most cited key factors for information systems implementations. They also observed a

variance with regard to what it entails and therefore is not clear which change management strategies would work. The change management has also been highlighted as a mandatory intervention to restructure the operational processes of the organization to make them appropriate to make them fit into the new information systems [20]. Osnes et al. [20] study recommends a continuation of the change management strategies and measurement scales in the implementation or development phase of new IS for the post-acceptance phase. Change management is one of the key factors that has a history of influencing information systems implementations success or failure. For example, in their study to identify the success factors for the IS implementation, Wijaya et al. [34] have also recommend the change management dimensions as extremely important for the IS implementation. On the contrary, Phaphoom et al. [35] study found change management as one of the factors that led to IS implementation failures.

Change management in the post-implementation phase such as effective use remains a gap that the higher education institutions must still consider [30]. A topic of change management framework for the effective use of information systems is at the nascent phase as highlighted in Osnes et al. [20] study. A crucial step in ensuring effective use of information systems is having a better grasp of the change management dimensions for effective use. This would among others require management to produce knowledge on what the EAS user community want to effectively use EAS. To attain this, management requires an appraisal and the application of the effective change management [5]. Few authors drew up discrete dimensions of change management [5], [7], [8], [9], [10], [11], [14], [15], [16]. However, there are limited discrete dimensions for the change management especially in post-implementation phase such as effective use of EAS from literature. Next section discusses the theories for use and effective use.

2.1.2. Use Theories

This paper makes on UTAUT and the Effective Use Theory in developing a CMM for effective use of EAS. The two information systems theories are chosen as the previous studies have relied on the theoretical models such as Aladwani [36] model; Contingency model of IT organization; Stages of Growth Model; Prosci's ADKAR [37]; Kotter Eight Steps Model [38], McKinsey 7S model [39] and ITIL 3 [40] as cited in Sulistiyani and Susanto (2018) built to explain the change management with no regard to the post-acceptance behaviour such as effective use. The previous studies dimensions of change management were adoption rather than post-adoption phase (effective use) which is the focus of this study. This study also recognize that there are individuals (McKinsey 7S model [39]; Prosci's ADKAR [37], organization (Prosci's ADKAR [37]; Kotter Eight Steps Model [38]; McKinsey 7S model [39]; environment (Task-Technology Fit model [41]) and technology (ITIL 3 [40]) change factors for the use. However, this study focuses

on the individual (EAS end users) factors for the use and subsequent effective use of EAS.

In this paper, the change management dimensions are regarded as facilitating conditions of the use of technology in the UTAUT. One of the motivation for the adoption of UTAUT theory is according to Venkatesh et al. [42], the UTAUT model has been applied in many various research contexts for instance e-library [43] and technology acceptance [44]. From this study literature review there, is inadequate application of the UTAUT model in particular the EAS in South Africa's TVET colleges settings. Venkatesh et al. [42] also reported some progress in the area on UTAUT integration with other models such, as information systems success model [45] and, Task-Technology Fit [46]. These researchers also observed scanty integration of UTAUT with other use models. Therefore the UTAUT is viewed as could be a strong basis for identifying the change management measure scales for EAS use and subsequent effective use. The other relevant theory is Effective Use Theory, which is discussed next.

The Effective Use Theory (EUT) is an information system theory based on the representational theory established by Burton-Jones & Grange [3] to explain any information systems effective use and model the nature (i.e., representational fidelity, transparent interaction and informed action). The EUT is akin to representation theory nature and drivers (i.e., adaptation, learning, verification activities) of effective use. The EUT theorizes that representational fidelity, transparent interaction and informed action determines one's effective use level.

A key component of the theory is that information system is used in a manner that assists individuals to achieve relevant goals, a transition from the system use theory [47], which is to carry out activities to attain specific goals. Burton-Jones and Grange [3] based their notion of effective use on the representation theory [48], [49] which states that any IS comprises physical, surface, and deep dimensions. Premised on the grounding theory of representation the effective use is generic in nature, whereby its three hierarchically related dimensions (i.e. representational fidelity, transparent interaction and informed action) and three sub-dimensions (i.e. verification, adaptation and learning) are proposed to be applicable to any information systems [13]. Validation and extension of the EUT has been left to future studies.

Trieu et al. [19], Yang et al. [21] and Eden et al. [22] studies have demonstrated that there is merit in using Effective Use Theory (EUT) to study to the effective use. Ergo, this research also builds on the EUT to explain the salient activities and dimensions (i.e., representational fidelity, transparent interaction, informed action, EAS verification, EAS adaptive use and user learning) of effective use. From the EUT literature review, the theory has not been tested in context of the EAS in the African continent especially the TVET colleges in South Africa setting. Although

Burton-Jones and Grange [3] also argue the applicability of EUT on various types of IS. The object of effective use is also in line the EAS in post-acceptance phase (e.g., delivering the examination administration effectively). It is also important to highlight that EUT previous use is evident in the literature [22], [23] and the dimensions that constitute effective use have relatively remained the same. Therefore, EUT is also more appropriate for use to explain effective use of EAS. Next is the discussion on the effective use within the EAS.

2.1.3. Effective Use within the Examination Administration System

A lack of use or partial use of EAS is of great concern to Government as it invested huge amount of cash on Examination Administration System to improve the examination administration and support the business processes in higher education institutions, specifically TVET colleges. The challenge of lack or partial use of information system is known as Recker et al. [1] acknowledged that as the information system evolves, the key issue is to ensure that information systems is used effectively which remain a challenge to date. It is against this background that an idea was conceived of finding out the measurement indicators for effective use of information systems. Therefore, from that view it is of great importance to know what worked or not worked or how the use of EAS can be improved for it to be fully used and/or effectively used.

According to Burton-Jones & Straub [47] an individual-level information systems use implies a single user employing features of the system to carry out an activity. A user in this paper refers to an individual who uses the EAS which include direct and indirect users [50]. In this paper, the EAS use definition adopts the aggregate construct formulation. It is defined in terms of 180-degrees three equal angles (i.e. 60 degrees' angles) which are the EAS users performing examination administration (task or activities) on EAS. The highlight of this conceptualization is that there is 360 degrees change management circle (activities (examination administration), organization/group structures (EAS users), change or system & processes (EAS) which carries out an informatics square with four equal angles (inputs, processing, output, and data storage)).

Koo et al. [51] define the exploitative use (EAS use) as making use of more available EAS features to accomplish the activities. Whereas explorative use refers to making a use of the EAS in a novel/innovative way to support the tasks [51]. Koo et al. [51] in their study to investigate the explorative and exploitative uses of smartphones found that exploitive use has an impact on the explorative use. March [52] also argues that exploitation activities influences the explorative activities such as experimentation, change (technology use in context of this study) and innovation. Therefore, adding the variables such as adaptive use (explorative use) and technology use (exploitative use) dimensions will add to the mechanism

through which the effective use of EAS can be achieved. These additions extends the EUT, UTAUT and integrates the change management into acceptance theories. This is also respond to recommendations by previous studies such as Trieu et al. [19] and Eden et al. [22]. To extend the nomological network surrounding effective use. The next section presents a theory driven research model, construct and hypotheses.

2.2. Research Model, Constructs and Development of Hypotheses

This paper develops a model for effective use of EAS by integrating the EUT [3] and UTAUT [2] to introduce new nexuses between these theories constructs. The EUT has dimensions and sub-dimensions that influence effective use. This study introduces CMFs (i.e., Top management support/guiding team and activities, the change recognition, shared vision for the change, planning a project as a change, performance measurement, effective communication, user training, user involvement, user satisfaction and information flow) as facilitating conditions exert influence the effective use of Examination Administration System through EAS use and adaptive use. The technology (use) is a context specific driver of effective use since the EAS adaptation can only be influenced by the use of EAS (technology use) [51]. This nexus does not exist in the existing body of EUT application and extension. The research model also incorporates both the EAS adaptive use, user learning and verification activities which have all not been tested concurrently in the literature ever since the EUT proposed them as drivers of effective use behaviour. Any activity that EAS user take to verify, learn and adapt it will improve the effective use [3]. Therefore, it is important to investigate these sub-dimensions of the effective use of EAS. They are all hypothesized to influence transparent interaction in this study. With the introduction of EAS adaptive use to EUT, this study also adds the EAS (technology) use (exploitation activities) as a determinant of EAS adaptive use as March [52] argues that use activities bolster the adaptive use activities.

Facilitating conditions refers to a degree to which users/organizations or groups believe that they have technical/organization resources and support exists to support the use of system [43]. On the research model, the variable accounts for the external (e.g. individual/ group/ organization interventions such as change management programs) factors (determinants) in the environment [53]. It is against this background that the CMFs are viewed as facilitating conditions.

The study integrates CMFs as other instrumental predictor of Examination Administration System (technology) use in order to assess their influence on the EAS use and subsequent effective use. The integration of CMFs is in keeping with Venkatesh et al. [42] who suggest that this type of work supplement the UTAUT attention on the intentionality as the main determinant of a technology use behaviour. The CMFs in this study context are key factors that influence the use

as the purpose of this study is to expound the use and subsequent effective use of EAS in South African TVET colleges. The change management activities (factors) are important as the use of EAS represent the change in the South African TVET colleges setting.

Ever since Venkatesh et al. [2] theorized facilitating conditions as having effect on UB and empirically proving that the FCs partially influence technology use; there has been accumulative evidence that supported the theory. Studies such as Mashaba and Pretorious [43] and Dwivedi et al. [44] also demonstrate that facilitating conditions have effect on the use of technology. It is for this reason that the UTAUT model was espoused in this study.

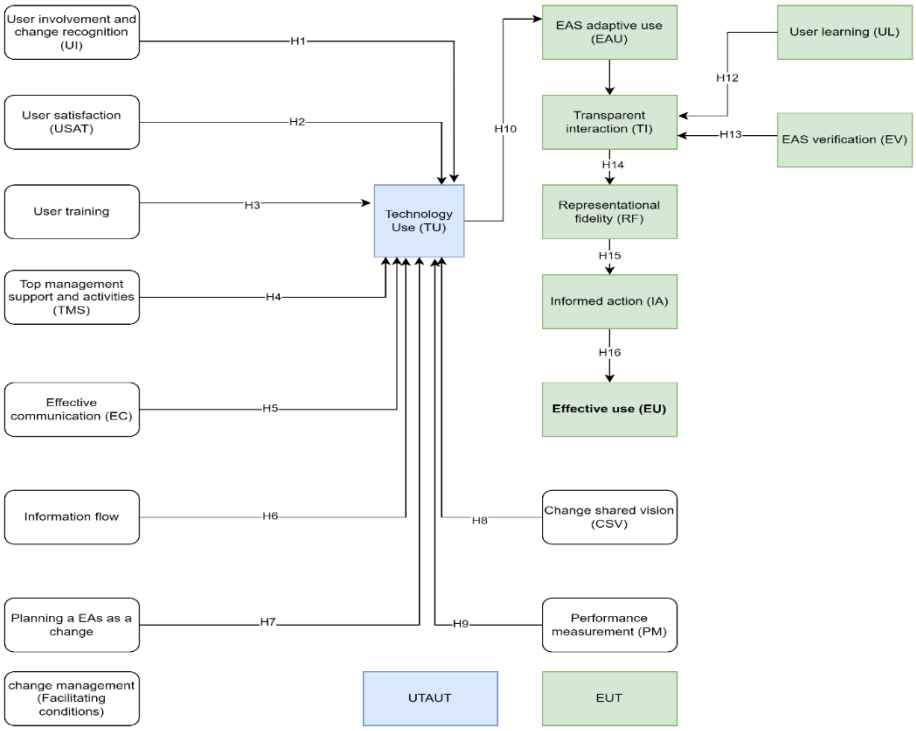

Figure 1.: Research Model

The CMFs are essential pre-conditions to EAS use as previous studies established facilitating conditions as instrumental to technology use [2], [54], [55]. The study seeks to extend UTAUT by including CMFs to provide a comprehensive theoretical perspective of users' technology use in context of EAS. These CMFs were also found to increase success of the information systems implementations in institutions of higher learning and in general information systems adoption [5],

[9], [10], [11]. This study also focuses on individual CMFs toward the actual use of EAS. In this study, it is argued that EAS use leading to effective use can be realized through a sound change management programme. Therefore, the CMFs are viewed as facilitating conditions in context of this study. Therefore, the CMM for the effective use of EAS is premised on the integration of Ziemba and Oblak [11] change management framework, UTAUT [2] and EUT [3]. Figure 1 demonstrates a theory driven research model. Next section operationalization of research constructs, construct codes and hypotheses.

2.2.1. User involvement and change recognition (UI)

UI denotes the degree to which EAS users were involved in activities such business process planning, system design, system requirement, implementation of business processes, training and volition to learn about EAS. The user involvement in these processes can lead to fulfilment of user requirements and consequently contributes to EAS use [56]. Kalema [57] study had user involvement as part of organizational factors and findings revealed that organizational factors had significant influence on the effective use of the information systems. If users are involved in the system requirements for changes and training post-implementation, they are more likely to use the system effectively. Thus, this paper proposes that:
Hypothesis 1 (H1): User involvement and change recognition positively influences the EAS use.

2.2.2. User satisfaction (USAT)

USAT denotes the degree to which the information systems is meeting the user community expectations [56]. Delone and McLean [58] who reported that satisfaction is a key component for computer systems success. Bolen and Özen [59] also found that user satisfaction stimulates the use of technology. Notwithstanding that the EAS is mandatory to use, the extent of EAS use will still depend on users' satisfaction [60]. Based on this understanding the following hypothesis was tested.
Hypothesis 2 (H2): User satisfaction positively influences the use of EAS.

2.2.3. User training (UT)

UT is the extent to which an EAS user has been trained on how to use EAS through training presentations, self-study, manuals or any other means [10]. Other information systems researchers such as Kalema [57] and Phahlane [61] found that training had significant influence on use of the information systems. Furthermore, researchers such as Osnes et al. [20] suggest that the training of users is a key post-

acceptance intervention that increases acceptance. Therefore, this paper conjectures the following hypothesis.
Hypothesis 3 (H3): User training positively influences EAS use.

2.2.4. Top management support and activities (TMS)

TMS is viewed as degree to which top management provide support for EAS use by carrying out organizational activities such as policies, procedures, regulations formulation and objectives, provisioning of resources and training, analyze the resistance roots and apply appropriate strategies to offset them, organizational realignment of workflow (processes) as a result of EAS, continuously monitor progress against the plan/project schedule [10]. Yang et al. [21] in a study of health information systems effective use have established that TMS influences effective use. With such acknowledgement by the scholars, TMS is a wielding factor in IS effective use. Therefore, this paper conjectures:
Hypothesis 4 (H4): Top management support and activities positively influences EAS use.

2.2.5. Effective communication (EC)

EC refers to a degree to which an EAS user communities have been informed about the use of EAS (adapted from Ziemba and Oblak [11]. The communication especially among top management, information technology and EAS user community is important as it facilitates the exchange of information, ideas, resources, obtaining commitment, collective decision making and building consensus among the change subjects to strengthen operations during the post-acceptance phase [11], [62]. Kalema [57] study had interdepartmental cooperation and communication as part of organizational factors and found that organizational factors have significant influence on effective use of the system. Therefore, this paper hypothesizes that:
Hypothesis 5 (H5): EC positively influences EAS use.

2.2.6. Information flow (IF)

IF refers to the degree to which expectations and requests of the user community are fulfilled by the use of EAS information [11]. In this study, what sets the information flow apart from representational fidelity is that representational fidelity is a property of EAS effective use while IF is a property of EAS use [3]. The scholars found that information quality affects effective use [21]. Thus, the following is hypothesized:
Hypothesis 6 (H6): Information flow positively influences EAS use.

2.2.7. Planning a EAS as a change (PC)

PC refers to an extent to which there is a clearly documented change management process pertaining to the use of EAS [11]. Ziemba and Oblak [11] study found that during planning if you regard a project (use of EAS) as a change that is instrumental in achieving the success of information systems. Hence, the following hypothesis is posed:
Hypothesis 7 (H7): Planning a EAS as a change positively influences EAS use.

2.2.8. Change shared vision (CSV)

CSV denotes an extent to which EAS users know how EAS use will impact an organization (e.g., workflows transformation) or at least their jobs. Put differently, this is the degree to which EAS users know about use of EAS future destination (end goal) [11]. Ziemba and Oblak [11] established that the CSV also determines the success of information systems. Thus, the following hypotheses will be posed:
Hypothesis 8 (H8): Shared vision for change has a positive effect on EAS use.

2.2.9. Performance measurement (PM)

PM refers to a concept of recognition and reward [10] which is essentially a degree to which performance of examination administration on the EAS is gamified and assessed on an individual performance appraisal system including annual performance plan for the organization and its units. Previous studies argue that gamifying and assessing the execution of tasks on an individual performance appraisal system including annual performance plan for the organization serves as extrinsic motivation that mitigates a risk of partial or lack of system usage [10], [63]. Previous study has also evinced that the PM affects the success of the information systems [11]. Accordingly, hypothesis nine is posed:
Hypothesis 9 (H9): Performance measurement positively influences use of EAS.

2.2.10. Technology use (TU)

TU is tantamount to exploitative use is defined a as a degree to which individuals routinely use of EAS and its features to execute their activities [64]. Koo et al. [51] in their study to investigate the explorative and exploitative use of smart digital technologies found that exploitive use had a favourable impact on explorative use. The explorative use is synonymous to EAS adaptive use in this study which refers to a degree to which user communities make use of EAS features in an innovative way that sometime designers did not anticipates [64]. This is a context specific driver of effective use since EAS adaptive use can only be influenced by use of EAS (technology use). For example the use of EAS in an innovative way cannot exist without carrying out use of EAS to among others ascertain the limitation of

EAs in execution of examination administration. This nexus does not exist in the existing body of EUT application and UTAUT extension particularly in context of EAS in SA TVET colleges. Accordingly, from the supra understanding the hypothesis 10 is posed:
Hypothesis 10 (H10): Technology use positively influences EAS adaptive use.

2.2.11. EAS adaptive use (EAU)

EAU refers to an extent to which EAS users explore EAS by adjustments made to EAS either to enhance its ability to represent examination administration (reality) or to improve accessibility through the surface (e.g., reports or customize an interface of EAS per user role), deep structures (e.g., customize data rules and EAS features), physical structure (e.g., use of larger computer screens) to improve representation fidelity [64], [65]. The authors recognize that information systems are inherently malleable [66] and fallible. Therefore, voluntary repurposing and innovativeness on part of users will be required to achieve effective use [67]. Haake [23] study has established that the workarounds on the supply chain management system influence effective use. Although the examination administration processes are standardized in South African TVET colleges, there may be other functionalities on EAS that the TVET College users need to adapt to fit their local settings similar to users at the multi-nations organizations that use a central system in multiple locations [68]. Stemming from this understanding, EAU is theorized to influence transparent interaction.
Hypothesis 11(H11): EAS adaptive use positively influences the transparent interaction.

2.2.12. User learning (UL)

The user learning is defined as an extent to which EAS user communities exploit EAS by engaging in learning activities of the representational fidelity of EAS and learning how to access the transparent interaction (e.g., surface or physical structure) offered by EAS and leverage on them [19], [23]. Trieu et al. [19] in their study in business intelligence found a negative relation between learning and transparent interaction. The outcome could have been influenced by the context. In this study, UL is hypothesized as having influence on the transparent interaction of EAS premised on the EUT that is applicable to any information systems. From this reasoning the hypothesis 12 was formulated:
Hypothesis 12 (H12): User learning positively influences transparent interaction.

2.2.13. EAS verification (EV)

EV refers to an extent to which EAS user communities confirm expected benefits through their use experience with EAS [69]. EAS user communities are expected

to have expectations about EAS even for broad use. In post-acceptance of EAS, EAS users gain experience from using EAS and develop perceptions about it. The developed perceptions that will lead to EAS users either confirmation or disconfirmation of pre-acceptance expectations following assessment of perceived EAS against pre-acceptance expectations. Burton-Jones and Grange [3] advanced that the user communities may undertake verification activities to ameliorate effective use of EAS. Stemming from the supra, this study theorizes that:
Hypothesis 13 (H13): EV positively influences transparent interaction.

2.2.14. Transparent interaction (TI)

The transparent interaction denotes a degree to which one is able access EAS (representation) deep structures (e.g., tables) with ease and without being stymied by EAS surface (e.g., user interface, reports) and physical structures (e.g., computers, internet, and screens) and EAS stability [19]. Trieu et al [19], Yang et al. [21] and Eden et al. [22] have established that transparent interaction influences the effective use. The representational fidelity is expected to be facilitated by the transparent interaction [3]. In EAS context, when EAS users interact with EAS should be able to do so in unhindered manner. This understanding drove formulation of hypothesis 14:
Hypothesis 14 (H14): Transparent interaction positively influences the representational fidelity (RF) of EAS.

2.2.15. Representational fidelity (RF)

RF refers to a degree of fidelity to which an EAS user is obtaining representation from the Examination Administration System manifest a represented domain (examination administration). In other words, an EAS user obtains a clear, complete, correct, and meaningful information (informating process) about the represented domain (examination administration) from EAS to an extent [19]. Marchand and Raymond [70] and Haake [23] studies results confirmed the representational fidelity as dimension of effective use and correlation between representational fidelity and informed action as operationalized in EUT. A study by Campbell and Roberts [71], Eden et al. [22] and Trieu et al. [19] also found that RF enables informed decision making on part of users. For example, should EAS users clearly comprehend and have faith in the accuracy of EAS data, they can derive a more detailed picture of a TVET colleges'examination administration. From this standpoint and empirical studies, this study postulates the following:
Hypothesis 15 (H15): Representational fidelity positively influences EAS user communities' ability to carry out informed action.

2.2.16. Informed action (IA)

The informed action refers to an extent to which relevant, appropriate and correct information is leveraged/acted/decided on by EAS users to improve their state in an examination administration domain [19], [22], [23]. EUT postulates a hierarchical nexus between informed action and effective use. In line with Haake [23], Marchand and Raymond [70] and Eden et al. [22] study findings also confirmed that the effective use behaviour is formulated by the three hierarchically related dimensions (i.e., representational fidelity, transparent interaction and informed action), the study conjectures the following hypothesis as fit to be tested. Hypothesis 16 (H16): Informed action positively influences the EAS effective use.

The next section discusses the methodology followed to develop the CMM for effective use of EAS.

2.3. Research procedure

Firstly, the theory driven research model was developed premised on EUT, UTAUT and Change Management Framework which offers the facilitating conditions for effective use of EAS through technology use and EAS adaptive use. Thereafter the model was validated adopting a quantitative survey using a questionnaire to gather the data. The research constructs already entirely record the content of construct domain as stipulated research construct section (section 2.2). The first validity form has already been addressed in conceptualization, operationalization and data collection instrument development phases.

This study adopted population size (N) of 12 538 as reported in the report on lecturers qualification profile working in public colleges [72]. Raosoft Inc. [73] was used to calculate the sample size, margin of error was 0.05 confidence interval was 90%, response distribution was 50% resulting in a sample size of 265. The sample was inflated with 123 (46, 4%) to cater for non-responses. Therefore, this study sample size was 388 which is way above the minimum sample size for this study which is at least ten times the number of variables (17 constructs multiply by (*) 10) which is 170 sample size [74]. A total of 215 responses were received representing 55.4% response rate (RR) which is greater than the average RR (50+1)) [75]. Of the 215 respondents 139 were direct users and 71 indirect users which is satisfactory since the measurement scales are measuring effective use.

The questionnaire consists of 63 questions, using a five-point Likert scale (i.e., from strongly disagree (1) to strongly agree (5)), and was pilot tested through Microsoft forms with 17 target audience from eight different user cohorts. Thereafter, an online questionnaire was exported to Microsoft Excel spreadsheet to make it compatible with WarpPLS version 8.0 software and for researchers to check data completeness. The model was evaluated using adapted measurement and structural models evaluation phases offered by Hair et al. [76]; Hair et al. [74].

The reflectively measured constructs (i.e., user involvement and change recognition, user training, top management support and activities, planning a EAS as a change, change shared vision, performance measurement, technology use, user learning, EAS verification, transparent interaction, informed action and representational fidelity) were tested for: internal consistency reliability, convergent validity and discriminant validity in line with the measurement guide line proffered by Hair et al. [76]. In line with Hair et al. [76] guide, formatively measured constructs (i.e., information flow, EAS adaptive use and effective use) were also assessed for convergent validity, multicollinearity, and relevance of formative indicator weights and significance. The measurement items validity test was carried out using the convergent and discriminant validity tests through the output results of combined loadings and cross loadings.

3. RESULTS AND DISCUSSIONS

This section presents and discusses results of the research model.

3.1. Results Presentation

The results also show that Gauteng Province recorded the highest participation rate of 25% (n=53) of participants (n=215). These figures to a degree are in congruent with the demographics representation in Statistic South Africa mid-year population estimates report [77] that indicates that the Gauteng Province has largest share of population in South Africa with approximately 26.6% (n= 16.10 million of 60,60) people. Given this paper descriptive results resembles that of the country demographics, partial least-squares structural equation modeling (PL-SEM) results are expected to account for the effective use of EAS in all South African TVET colleges in nine provinces. The structural model was tested making use of the PLS-SEM. The structural model stems from the measurement model test results.

Next is Table 1 which presents the block/model variance inflation factors (VIF) test results. Table 1 presents all independent variable VIF results which were equivalent or lower than a threshold level of .10, indicating an acceptable reliability of independent constructs [78]. The CSV, EC and IF VIF values were not within the acceptable threshold level of .10 as both variables VIF values >.10 which presented a multicollinearity challenge in this block/model in line with Hair et al. [78] guide. Therefore, the latent variables (i.e., CSV, EC and IF) were eliminated to ensure that they do not affect the estimation of the regression parameters. In this paper full collinearity for all constructs presented in Table 1 was lower than .10 which bears testament to no lateral collinearity [79] synonymous to acceptable discriminant validity.

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Table 1. Model collinearity test results

Block	TMS	UI	USAT	PC	PM	TI	TU	RF	EU	EAU	EV	UL	IA	UT
TI										4.954	7.627	7.195		
TU	4.407	5.036	4.975	4.248	6.468									4.206

Abbreviations: UT - User training; TMS - Top management support and activities; UI - User involvement and change recognition; USAT - User satisfaction; EC - Effective communication; IF - Information flow; PC - Planning EAS as a change; CSV - Change shared vision; PM - Performance measurement; TU - Technology use; EAU - EAS Adaptive use; EV - EAS verification; UL - User learning; TI - Transparent interaction; RF - Representational fidelity; IA - Informed action; EU - Effective use.
Note: These variance inflation factors are for the independent variable on each column, with reference to the dependent variable on each row.

Ordinarily the two-step model building is performed in the SEM. However, the aspects of the exploratory factor analysis were carried out on all measurement scales to ascertain their reliability and validity in measuring each concept. Statistical analysis software (i.e. Statistical Package for Social Science version 28.0.1.0) was used to produce the Kaiser-Meyer-Olkin measure of sampling adequacy of 0,979 greater than 0.60 which means this paper sample was suitable for application of factor analysis [80]. WarpPLS version 8.0 software was used to perform computation for standardized factor loadings and Heterotrait-Monotrait (HTMT) ratio results. All the standardized factor loadings were significant at the p-level <0.001 and loading values ranged from 0.859 to 0.950. Therefore, all indicators convergent validity has been fulfilled. All construct HTMT ratio results were less than 1.00 as suggested by Henseler et al. [81]. Therefore, discriminant validity of the measurement model was confirmed.

The last step was to test the construct association and hypotheses using the WarpPLS version 8.0 software. Next subsection presents PLS-SEM analysis and hypotheses test results. Table 2 presents the PLS-SEM analysis and hypotheses test results which indicate that 10 out of 16 hypotheses were supported from data collected. The three hypotheses were eliminated as the associated latent variables (i.e. CSV, EC and IF) had a potential to make path model unfit and non-recursive. The three hypotheses were also not supported by the data collected in this study, which affected the hypothesized relationship between TU and UT; TU and TMS also PC and TU. The overall model explains 62.5% (11 hypotheses out of 16) of the critical variables are important to be weighed in order to measure effective use of EAS.

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Table 2. PLS-SEM analysis and hypothesis test results

Path ➔	Hypothesis Number	Hypothesis statement	Path Coefficient	T-value	*P*-value	Sig	Hypotheses test outcome
User involvement and change recognition (UI) ➔ TU	H1	User involvement positively influences the EAS use.	0.14	2.129	p=0.02	**	Significant and supported
User satisfaction (USAT) ➔ TU	H2	User satisfaction positively influences the use of EAS.	0.17	2.565	p<0.01	**	Significant and supported
User training (UT) ➔ TU	H3	User training positively influences EAS use.	0.10	1.482	p=0.07	ns	Not significant and supported
Top management support and activities (TMS) ➔ TU	H4	Top management support and activities positively influence EAS use.	0.02	0.348	p=0.36	ns	Not significant and supported
Effective communication (EC) ➔ TU	H5	EC positively influences EAS use.	nt				
Information flow (IF) ➔ TU	H6	Information flow positively influences the EAS use.	nt				
Planning a EAS as a change (PC) ➔ TU	H7	Planning a EAS as a change positively influences the EAS use.	0.04	0.613	p=0.27	ns	Not Significant and supported
Change shared vision (CSV) ➔ TU	H8	Shared vision for change has a positive effect on EAS use.	Not Tested				
Performance measurement (PM) ➔ TU	H9	Performance measurement positively influences the use of EAS.	0.53	8.490	p<0.01	***	Significant and supported
Technology Use (TU) ➔ EAU	H10	Technology use positively influences EAS adaptive use.	0.87	14.958	p<0.01	***	Significant and supported
EAS adaptive use (EAU) ➔ TI	H11	EAS adaptation positively influences the transparent interaction.	0.21	14.958	p<0.01	***	Significant and supported
User learning (UL) ➔ RF	H12	User learning positively influences transparent interaction.	0.51	8.298	p<0.01	***	Significant and supported
EAS verification (EV) ➔ TI	H13	EAU verification positively influences transparent interaction.	0.16	2.422	p<0.01	**	Significant and supported
Transparent interaction (TI) ➔ RF	H14	Transparent interaction positively	0.90	15.589	p<0.01	***	Significant and supported

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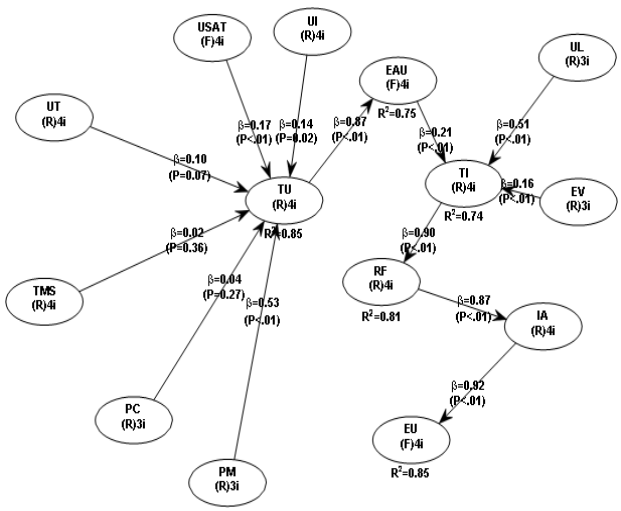
Path ➔	Hypothesis Number	Hypothesis statement	Path Coefficient	T-value	*P*-value	Sig	Hypotheses test outcome
		influences the representational fidelity of EAS.					
Representational fidelity (RF) ➔ IA	H15	Representational fidelity positively influences EAS user communities' ability to carry out informed action.	0.87	15.058	p<0.01	***	Significant and supported
Informed action (IA) ➔ EU	H16	Informed action positively influences the EAS effective use.	0.92	16.070	p<0.01	***	Significant and supported
Effective Use (EU) [R2= 0.85] **Technology Use (TU) [R2=0.85]** **Informed action (IA) [R^2=0.76]** **Representational fidelity (RF) [R^2=0.81]** **EAS adaptive use (EAU) [R^2=0.75]** **Transparent interaction (TI) [R^2=0.74]**							
Significance (Sig) threshold levels [82]: • * refers significance at p=0.10 (T=1.645) • ** refers significance at p=0.05 (T=1.960) • *** denotes Significance at p=0.01 (T=2.576) • ns denotes Not significant • nt denotes Not tested							

Abbreviations: UT - User training; TMS - Top management support and activities; UI - User involvement and change recognition; USAT - User satisfaction; EC - Effective communication; IF - Information flow; PC - Planning EAS as a change; CSV - Change shared vision; PM - Performance measurement; TU - Technology use; EAU - EAS Adaptive use; EV - EAS verification; UL - User learning; TI - Transparent interaction; RF - Representational fidelity; IA - Informed action; EU - Effective use.



Abbreviations: UT - User training; TMS - Top management support and activities; UI - User involvement and change recognition; USAT - User satisfaction; PC - Planning EAS as a change; PM - Performance measurement; TU - Technology use; EAU - EAS Adaptive use; EV - EAS verification; UL - User learning; TI - Transparent interaction; RF - Representational fidelity; IA - Informed action; EU - Effective use

Significance threshold levels (Hair et al. [82]): * denotes Significance at p=0.10 (T=1.645). ** denotes Significance at p=0.05 (T=1.960) *** denotes Significance at p=0.01 (T=2.576

Figure 2. PLS-SEM analysis results on the research model

Next step is to test the structural model's explanatory power [76]. From the R^2 results evinced on Table 2, the adjusted R-squared values for all dependent variables were greater and equal to threshold of 0.10 recommended by Hair et al. [76]. Therefore, it can be concluded that based on the adjusted R^2 values (i.e., coefficients of determination) fully represented an amount of explained variance of all endogenous constructs in proposed research structural model.

Once the model explanatory power has been established. Next phase is a predictive power test on the structural model [76]. Table 3 evinces values of effect size (f2) for this paper research model. There is no thumb rule for effect size values but the Hair et al. [74] proffered 0.35, 0.15 and 0.02 or greater values represent large, medium and small f2 respectively.

As has been shown in Table 3, the effect size analysis results show that all the effect sizes of independent variables were greater and equal to threshold of 0.02 recommended by Hair et al. [74] with exception of TMS. This means all the independent variables had required effect size and sufficiently explained the dependent variables with exception of TMS effect on the TU as it was negligible with effect size value of 0.018. This study variable $f^2 >= 0.02$ confirms model predictive power.

Table 3: The proposed research model effect size (f^2) test results.

Independent construct code ➔	**Dependent construct**	**f2 value**
UT	TU	0.079
TMS	TU	0.018
UI	TU	0.116
USAT	TU	0.140
PC	TU	0.032
PM	TU	0.466
TI	RF	0.810
EAU	TI	0.177
EV	TI	0.131
UL	TI	0.436
IA	EU	0.853
TU	EAU	0.754
RF	IA	0.763

Note: ➔ denotes path

Abbreviations: UT - User training; TMS - Top management support and activities; UI - User involvement and change recognition; USAT - User satisfaction; PC - Planning EAS as a change; PM - Performance measurement; TU - Technology use; EAU - EAS Adaptive use; EV - EAS verification; UL - User learning; TI - Transparent interaction; RF - Representational fidelity; IA - Informed action.

In addition to the value of f^2 the duplicity cross-validated redundancy indicator (Q^2) was computed to prove the predictive relevance/validity of endogenous

constructs though the literature review shows that the inner model evaluations prior 2000 and post do not show any study that reported Q^2 and relative predictive relevance (q^2) [82]. Next is discussion of Q^2 test results. As shown in Table 4, all the blindfolding outcomes (Q^2) are greater than (>) zero (0). Therefore, the model predictive relevance for all endogenous constructs in the model has been established.

Table 4: Predictive relevance Q^2

Construct code	Q^2
TI	0.740
TU	0.815
RF	0.810
EU	0.854
EAU	0.757
IA	0.765

Abbreviations: TU - Technology use; EAU - EAS Adaptive use; TI - Transparent interaction; RF - Representational fidelity; IA - Informed action; EU - Effective use.

In addition, to fully and accurately understand the nature of the cause–effect relationships. Table 5 presents the exploratory mediation test results. The mediation test results are discussed following Cepeda et al. [83] guide. Multi mediation analysis results in Table 5 revealed existence of direct relationships between transparent interaction and effective use through representational fidelity and informed action. The multi analysis results moreover, reveal existence of an indirect relationships transparent interaction and effective use through representational fidelity and informed action. The multi analysis results also reveal existence of an indirect relationships between user learning, and effective use through representational fidelity, transparent interaction and informed action. The multi analysis results further reveal existence of an indirect relationships EAS adaptive use and effective use through representational fidelity, transparent interaction and informed action. The multi analysis results reveal existence of an indirect relationships EAS verification and effective use through representational fidelity, transparent interaction and informed action. Lastly, multi analysis results reveal existence of an indirect relationships between technology use and effective use through EAS adaptive use, representational fidelity, transparent interaction and informed action.

Table 5: Exploratory mediation test results

Indirect effect on Effective use **Indirect path (effect) on Effective use**	**Path coefficient**	***p*-value**	**Effect size (f^2) for indirect effect**	**Significance**
RF =>IA=>EU	0.807	$p<0.001$	0.696	sig

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Indirect effect on Effective use **Indirect path (effect) on Effective use**	**Path coefficient**	***p*-value**	**Effect size (f^2) for indirect effect**	**Significance**
TI=>RF=>IA => EU	0.726	p<0.001	0.630	sig
UL=>TI=>RF=>IA => EU	0.373	p<0.001	0.296	sig
EAU=>TI=>RF=>IA => EU	0.154	p<0.001	0.121	sig
EV=>TI=>RF=>IA => EU	0.116	p=0.001	0.092	sig
TU=>EAU=>TI=>RF=>IA => EU	0.134	p<0.001	0.113	sig
TMS=>TU=>EAU=>TI=>RF=>IA=>EU	0.003	p=0.455	0.002	nsig
UI=>TU=>EAU=>TI=>RF=>IA=>EU	0.019	p=0.248	0.015	nsig
USAT=>TU=>EAU=>TI=>RF=>IA=>EU	0.023	p=0.207	0.018	nsig
PC=>TU=>EAU=>TI=>RF=>IA=>EU	0.006	p=0.421	0.004	nsig
PM=>TU=>EAU=>TI=>RF=>IA=>EU	0.070	p=0.006	0.057	nsig
UT=>TU=>EAU=>TI=>RF=>IA=>EU	0.013	p=0.316	0.010	nsig
TMS=>EU	0.003	p=0.455	0.002	nsig
UI=>EU	0.019	p=0.248	0.015	nsig
USAT=>EU	0.023	p=0.207	0.018	nsig
PC=>EU	0.006	p=0.421	0.004	nsig
PM=>EU	0.070	p=0.006	0.057	nsig
TI=>EU	0.726	p<0.001	0.630	sig
TU=>EU	0.134	p<0.001	0.113	sig
RF=>EU	0.807	p<0.001	0.696	sig
EAU=>EU	0.154	p<0.001	0.121	sig
EV=>EU	0.116	p 0.001	0.092	sig
UL=>EU	0.373	p<0.001	0.296	sig
IA=>EU	0.923	p<0.001	0.853	sig
UT=>EU	0.013	p=0.316	0.010	nsig

Significance (Sig)

- sig denotes Significant
- nsig denotes Not Significant

Abbreviations: UT - User training; TMS - Top management support and activities; UI - User involvement and change recognition; USAT - User satisfaction; EC - Effective communication; IF - Information flow; PC - Planning EAS as a change; CSV - Change shared vision; PM - Performance measurement; TU - Technology use; EAU - EAS Adaptive use; EV - EAS verification; UL - User learning; TI - Transparent interaction; RF - Representational fidelity; IA - Informed action; EU - Effective use.

Table 5 presents the indirect relationships observed in this study although not all were theorized. Table 5 shows that all the mediators theorized in this study were significant. The future studies could potentially theorize these results as the study results highlights the importance of these relationships.

3.2. Discussions

This study supports previous theories offered in the literature that effective change management programme increases the success of the information systems in higher education institutions [5], [11]. This study outcome also supports that CMFs have influence on the EAS use and subsequent effective use in TVET

colleges [11]. These findings also corroborate the theory that the facilitating conditions in this case CMFs make EAS use easier [2], [55]. This also supports the central claim of this study that the EAS use and subsequent effective use can be realized through sound change management. The study results further supports the theory that any activity that a user takes to adapt the EAS, verify the EAS and learn improves the effective use of the EAS [3]. Burton-Jones and Grange [3] identified that information systems adaptive behaviour as one of the drivers of the effective use of information systems, this is attributable to the information systems use that bolsters the information systems adaptive use. These findings offer a substantive theoretical contribution due to scanty research on the nexus between EAS use with EAS effective use. These immediate nexus findings are in keeping with those of Koo et al. [51] who found exploitative use stimulates the exploratory use in information systems infusion stage.

The findings show that from the UTAUT view [2], [57], the organizations that focus on change management initiatives (facilitating conditions) such as user involvement & change recognition, performance measurement and user satisfaction make the use of EAS. This is also true from the change management view that organizations with these change management initiatives have higher changes of information systems implementations [10], [11]. This study outcome reveals significant nexus between user involvement and change recognition, performance measurement and user satisfaction and technology use cementing UTAUT theory that facilitating conditions makes technology use easier [44]. These results also align with Rouibah et al. [84] findings that the user involvement affects the usage of information systems. The findings on the user satisfaction and EAS use also mimic Bolen and Özen [59] study results which revealed that user satisfaction influences the information systems use. The findings on the user satisfaction and EAS use are contrary to Kim et al. [45] findings but could be attributed to the fact that the use was voluntary in their study.

However, findings also reveal that the impact of training of user communities, planning a EAS as a change and top management support & activities on the technology use were found insignificant, which contradict the previous studies findings [11], [21], [61]. This study discrepant results could also mean that training of EAS user communities and planning a EAS as a change require a different specification in order to positively influence the use of EAS. These statistical results are incongruent with the results of user involvement and technology use as they suggest that somehow the top management support and activities were not viewed as a form of user involvement. These results could also suggest that the TVET colleges' top management is not visible and active hence the results mimic Ziemba and Oblak [11] study findings. Therefore these results explain the reasons for the effective use of EAS. Accordingly, this contributes to answering this study's primary question of "What factors influence effective use of EAS?"

This study also found a substantial impact of EAS (technology) use on EAS adaptive use. This outcome supports previous study that has evinced the favourable impact of exploitative use on explorative use [51]. These results confirm the inevitable notion that the EAS adaptive use cannot take place without the use of EAS. For example the EAS features cannot be merged, repurposed and expanded if EAS has not been used for examination administration and limitation determination made. One EAS use limitation determination is made so the user community can then think of new ways (e.g. repurpose, combine feature) to carry out examination administration or achieve a goal.

This study also found a substantial impact of EAS adaptive use, EAS verification and user learning on transparent interaction. These results support the EUT that hypothesized that these three sub-dimensions are also drivers of effective use outcome. These findings support previous studies that have demonstrated the significant impact of adaptive use and user learning actions on effective use [23], [85]. These results also support the proposition that the information systems are inherently malleable [66] and fallible hence the adaptive, verification and learning activities are required. These results provide evidence that effective use of the EAS is influenced by individual capacity to customize system functionality, learn and verify the representation from EAS [13].

The results from the study sample reveal that the mediators (i.e., technology use, representational fidelity, transparent interaction, EAS adaptive use and informed action) had a substantial impact on effective use of EAS. The results corroborate the finding that when the change management activities and process are managed, they could lead to successful IS implementations and most importantly assist the institutions of higher learning such as TVET colleges to manage the EAS use (change) [5]. Likewise these results on representational fidelity, transparent interaction and informed action as mediators are also in line with the previous information systems studies [22], [86].

In this study technology use, EAS adaptive use, representational fidelity, transparent interaction and informed action partially mediated the relationship between user training, top management support & activities and planning a EAS as a change and effective use. These results demonstrate that initiatives such as user training, top management support & activities and planning a EAS as a change could be key in improving technology use that lead to improved effective use of EAS. These results also reveal the dimensions and sub-dimensions of the effective use in the EAS context and confirm the applicability of EUT across the multiple system types [13].

From configuration analysis, it can be deduced that none of the conditions, that are neither transparent interaction, technology use, representational fidelity, representational fidelity, EAS adaptive use, dimensions nor informed action, are

sufficient to explain the high level of effective use of EAS solely. The strongest solution for effective use is in Table 5 that indicates 81.5 % of technology leads to a high level of effective use. This finding reveals that surveyed participants believe that TVET colleges can achieve higher effective use of EAS through an increased focus on the use of EAS in combination with other dimensions and sub-dimensions of effective use.

To achieve an objective of this research, which is to model the CMFs that are significantly affecting EAS use leading to the effective use of EAS. The Figure 3 presents the modified diagrammatical representation of the path model showing the supported hypotheses.

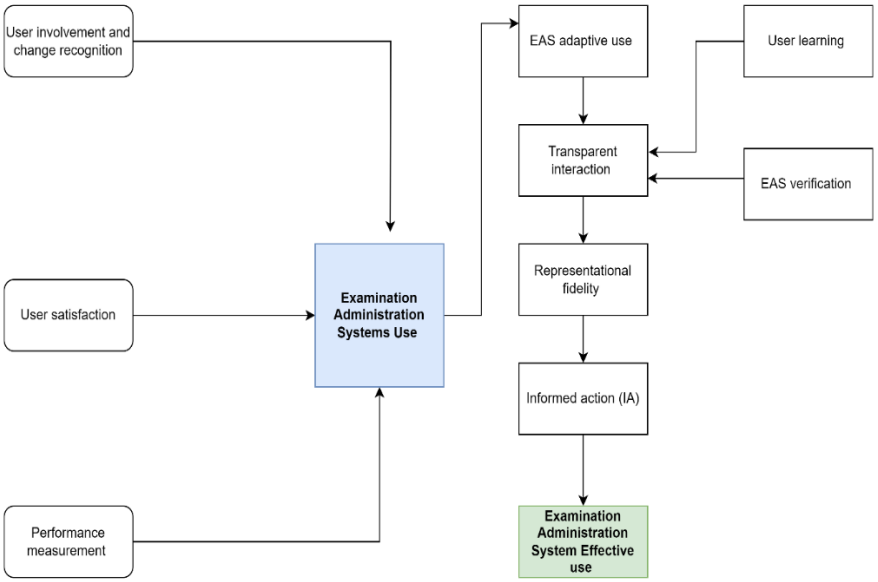

Figure 3. Model for the effective use of Examination Administration System

4. CONCLUSION

This study confirms a prominent view in literature that effective use of EAS is an outcome of sound change management. This paper proffers a nomological CMM of effective use of EAS shown in Figure 3. This study results also provide an empirical evidence of effective use of EAS in South Africa's TVET colleges. This paper findings reveal that user involvement & change recognition, performance measurement and user satisfaction have significant impact on different mediators, technology use, EAS adaptive use, representational fidelity, transparent interaction and informed action. However, the findings also reveal that the impact of training

of user communities, support of top management & activities and planning a EAS as a change on the technology use were found insignificant. The study also found strong effect of technology use, EAS adaptive use, representational fidelity, transparent interaction and informed action on effective use of EAS.

From configuration analysis, this study infers that none of the conditions that are neither transparent interaction, technology use, representational fidelity, EAS adaptive use, dimensions nor informed action, are sufficient to explain the high level of effective use of EAS exclusively. This study found five solutions (i.e., technology use, EAS adaptive use, representational fidelity, transparent interaction and informed action) with different integrations of configurations leading to effective use of EAS.

This study goal was to develop integrated model for effective use of Examination Administration System in South Africa's Technical and Vocational Education and Training colleges. However, there were limitations such as context and time given that this was an academic study that needed to be completed within stipulated time. The future studies could test the model in diverse settings to expand its generalizability. The future studies could also adopt the longitudinal as convoluted behaviour such as effective use may be better construed through a longitudinal study. In addition, the longitudinal studies may investigate information systems where use is voluntary or both volition and mandatory. Future studies may also take a form of comparative studies between private and public TVET colleges or even between developed or developing economics. The collection of more qualitative data would also provide in-depth insights into the CMM for effective use which was not possible in this study due to limited scope and resources, such as time.

Management and practitioners should equally concentrate on the facilitating conditions to improve effective use of EAS. In that way, organizations and authorities may be better positioned to manage digital technology change initiatives such as EAS. This paper recommends a model as a guide for influencing the user community to effectively use information systems in diverse contexts (e.g., EAS). Authorities and executives should pay more attention to strategic management of effective use of EAS given that it represents the examination administration and serves as one of the tools to measure performance of the TVET sector's service delivery/performance of the TVET sector. As one of the indicators is performance measurement, effective use may account for improvement of employees job performance and in turn organizations service delivery/ performance and competitiveness. Therefore the dimensions of model are as important as individual and organizations or functions (e.g., examination administration) performance indicators given that the nature of information systems represent the functional domains. For example in this paper the dimensions are facilitators of effective use behaviour.

REFERENCES

[1] J. Recker, M. Indulska, P. Green, A. Burton-Jone, and R. Weber, "Information systems as representations: a review of the theory and evidence," *J. Assoc. Inf. Syst.*, vol. 20, no. 6, pp. 735–786, 2019.

[2] V. Venkatesh, M. G. Morris, B. G. Davis, and D. F. Davis, "User acceptance of Information Technology: Towards a Unified View," *MIS Q. MIS Res. Cent. Univ. Minn.*, vol. 27, no. 3, pp. 425–478, 2003.

[3] A. Burton-Jones and C. Grange, "From use to effective use: a representation theory perspective," *Inf. Syst. Res.*, vol. 24, no. 3, pp. 632–658, 2013.

[4] T. G. Smith *et al.*, "Creating a Practical Transformational Change Management Model for Novel Artificial Intelligence-Enabled Technology Implementation in the Operating Room," *Elsevier Inc Behalf Mayo Found. Med. Educ. Res.*, 2022.

[5] M. Rohmah and A. P. Subriadi, "Processes and activities for managing change in information systems implementation in higher education institution," *The Winners*, vol. 23, no. 1, pp. 51–64, 2022.

[6] S. Musungwini and L. Mono, "Developing a Change Management Model for Managing Information Systems Initiated Organisational Change: A Case of the Banking Sector in Zimbabwe," 2019, doi: 10.20470/jsi.v10i1.362.

[7] S. Yusif, A. Hafeez-Bai, and J. Soar, "Change management and adoption of health information technology (HIT)/eHealth in public hospitals in Ghana: A qualitative study," *Appl. Comput. Inform.*, vol. 18, no. 3/4, pp. 279–289, 2019, doi: 10.1016/j.aci.2019.11.007.

[8] K. E. Mogogole and O. Jokonya, "Conceptual framework for implementing IT Change Management within South African Public Sectors," in *International Conference on ENTERprise Information Systems / ProjMAN - International Conference on Project MANagement / HCist - International Conference on Health and Social Care Information Systems and Technologies*, Procedia Computer Science, 2018, pp. 835–842.

[9] O. K. Abatan and M. Maharaj, "Change management and the integration of information technology: Research notes from selected African universities," in *12th International Conference for Internet Technology and Secured Transactions (ICITST -2017)*, Infonomics Society, 2017, pp. 167–172. doi: 10.23919/ ICITST.2017.8356370.

[10] N. Chepa, M. N. Jasin, and N. A. Abu Bakar, "How Change Management can prevent the Failure of Information System Implementation among Malaysian Government Hospitals?," in *AIP Conference Proceedings 1891*, vol. 3, 2017. doi: 10.1063/1.5005352.

[11] E. Ziemba and I. Obłąk, "Change management in information systems projects for public organizations in Poland," *Interdiscip. J. Inf. Knowl. Manag.*, vol. 10, pp. 47–62, 2015.

[12] R. Kapupu and M. Mignerat, "Change Management Strategies in ERP Implementations: A Case Study," in *Conference on Information Resources Management (CONF-IRM) 2015*, Association for Information Systems AIS Electronic Library (AISeL). [Online]. Available: http://aisel.aisnet.org/confirm2015/41

[13] A. Burton-Jones and C. Grange, "Using Information Systems Effectively: A Representational Perspective," in *Proceeding> Proceedings of JAIS Theory Development Workshop.*, Sprouts, 2008.

[14] M. M. Visser, "A methodology for the evaluation of management information systems at public technical and vocational education and training colleges in South Africa," Doctoral dissertation, University of South Africa, South Africa, Pretoria, 2017.

[15] M. M. Visser, J. A. van Biljon, and M. E. Herselman, "Evaluation of management information systems: A study at a Further Education and Training college," *SA J. Inf. Manag.*, vol. 15, no. 1, 2013, doi: dx.doi.org/10.4102/ sajim. v15i1.531.

[16] M. M. Visser, J. A. van Biljon, and M. E. Herselman, "Modeling Management Information Systems Success: a study in the domain of Further Education and Training," in *Kroeze, J.H. & De Villiers, R. (eds). SAICSIT '12 Proceedings of the South African Institute for Computer Scientists and Information Technologists conference*, South Africa, Pretoria: New York: Association of Computing Machinery, Oct. 2012, pp. 384–393. [Online]. Available: http://hdl.handle.net/20.500.11910/9018

[17] D2L, "Navigating Change Management in Higher Education," Navigating Change Management in Higher Education. Accessed: Jan. 01, 2024. [Online]. Available: https://www.d2l.com/blog/navigating-change-management-in-higher-education

[18] Y. E. Mrini, M. Belaissaoui, and I. Taqafi, "Difficulties Related to the Implementation of ERPs in Morocco: Focus on Change Management," *Am. Sci. Res. J. Eng. Technol. Sci. ASRJETS*, vol. 51, no. 1, pp. 47–55, 2019.

[19] V. Trieu, A. Burton-Jones, P. Green, and S. Cockcroft, "Applying and extending the theory of effective use in a business intelligence context," *MIS Q.*, vol. 6, no. 1, pp. 645–678, 2022.

[20] K. B. Osnes, J. R. Olsen, P. Vassilakopoulou, and E. Hustad, "ERP systems in multinational enterprises: A literature review of post-implementation challenges," in *CENTERIS - International Conference on ENTERprise Information Systems / ProjMAN - International Conference on Project MANagement / HCist - International Conference on Health and Social Care Information Systems and Technologies*, Procedia Computer Science, 2018, pp. 541–548.

[21] H. Yang, X. Guo, Z. Peng, and L. H. Lai, "The antecedents of effective use of hospital information systems in the Chinese context: A mixed-method approach," *Inf. Process. Manag.*, vol. 58, no. 2, 2021, doi: doi.org/10.1016/j.ipm.2020.102461.

[22] R. Eden, E. Fielt, and G. Murphy, "Advancing the Theory of Effective Use through Operationalization," in *Proceedings of the 28th European Conference on Information Systems (ECIS)*, Online AIS conference, Jun. 2020.
[23] P. Haake, "Understanding Effective Use in (Post) - Implementation Phase of Information Systems," Unpublished Doctoral DegreE Dissertation, Karlsruhe Institute of Technology (KIT), 2017.
[24] G. Piccoli and F. Pigni, *Information systems for managers: with cases*, 4.0. Prospect Press, 2018.
[25] E. Tantua and F. Godwin-Biragbara, "Management Information System and Office Productivity of the Print Media in Rivers State Nigeria," *Int. J. Bus. Law Res.*, vol. 8, no. 1, pp. 74–84, 2020.
[26] *Republic of South Africa National e-Government Strategy and roadmap (Notice 886 of 2017)*. 2017.
[27] *Republic of South Africa Continuing Education and Training Act 16 (CET Act 16)*. 2006. Accessed: Jan. 21, 2022.
[28] "The Statistics on Post-School Education and Training in South Africa 2021," Department of Higher Education and Training (DHETb), 2023. Accessed: Apr. 30, 2023.
[29] "United Nations Report, E-Government Survey: The Future of Digital Government," United Nations, 2022. Accessed: Jan. 01, 2023. [Online]. Available: https://desapublications.un.org/publications/un-e-government-survey-2022
[30] I. O. Adam, J. Effah, and R. Boateng, "Virtualisation of an administrative work environment in higher education," *J. Enterp. Inf. Manag.*, vol. 30, no. 5, pp. 723–747, 2017, doi: 10.1108/jeim-06-2016-0119.
[31] Z. T. Butarbutar, P. W. Handayani, R. R. Suryono, and W. W. Wibowo, "Systematic literature review of Critical success factors on enterprise resource planning post implementation," *Cogent Bus. Manag.*, vol. 10, no. 3, pp. 1–29, 2023, doi: 10.1080/23311975.2023.2264001.
[32] Y. Xie, C. Allen, and M. Ali, "Critical success factor based resource allocation in ERP implementation: A nonlinear programming model," *Heliyon*, vol. 8, no. 8, pp. 1–15, 2022, doi: 10.1016/J.HELIYON.2022.E10044.
[33] S. Finney and M. Corbett, "ERP Implementation: A Compilation and Analysis of Critical Success Factors," *Bus. Process Manag. J.*, vol. 13, no. 3, pp. 329–349, 2007.
[34] R. A. Wijaya, P. Widyaningrum, B. Prasetyo, and R. Satria, "Analyzing of Implementation Enterprise Budgeting System Using SAP BPC: Case Study on a Financial Government Institution," in *2018 International Conference on Advanced Computer Science and Information Systems (ICACSIS)*, 2018, pp. 475–480. doi: 10.1109/ICACSIS.2018.8618253.
[35] N. Phaphoom, J. Qu, A. Kheaksong, and W. Saelee, "An Investigation of ERP implementation: A Comparative Case Study of SME and Large

Enterprises in Thailand," in *International Conference on ICT and Knowledge Engineering*, IEEE, 2018, pp. 1–6.
[36] A. M. Aladwani, "Change management strategies for successful ERP implementation," *Bus. Process Manag. J.*, vol. 7, no. 3, pp. 266–275, 2001.
[37] T. Creasey, "Using the ADKAR model as a structured change management approach," Accessed: Dec. 23, 2021. [Online]. Available: https://blog.prosci.com/the-adkar-model-a-structured approach
[38] M. Almanei, K. Salonitis, and C. Tsinopoulos, "A conceptual lean implementation framework based on change management theory," in *51st CIRP Conference on Manufacturing Systems*, Procedia CIRP, 2018, pp. 1160–1165. doi: 10.1016/j.procir.2018.03.141.
[39] S. Sachdeva, "Change Management for e-Governance (Working Paper).," 2008.
[40] T. D. Susanta, "Manajemen Layanan Teknologi Informasi," *Surabaya AISINDO*, 2016.
[41] D. Goodhue and R. L. Thompson, "Task-technology fit and individual performance," *MIS Q.*, vol. 19, pp. 213–236, 1995, doi: 10.2307/249689.
[42] V. Venkatesh, J. Y. Thong, and X. Xu, "Unified Theory of Acceptance and Use of Technology: A synthesis and the Road Ahead," *J. Assoc. Inf. Syst.*, vol. 17, no. 5, pp. 328–376, 2016.
[43] M. C. Mashaba and A. B. Pretorius, "Electronic library resource use by postgraduate students at a university of technology in South Africa," *South Afr. J. Inf. Manag.*, vol. 25, no. 1, pp. 1–11, 2023, doi: 10.4102/sajim.v25i1.1602.
[44] Y. K. Dwivedi, N. P. Rana, A. Jeyaraj, M. Clement, and M. D. Williams, "Re-examining the unified theory of acceptance and use of technology (UTAUT): Towards a revised theoretical model," *Inf. Syst. Front.*, vol. 21, pp. 719–734, 2019, doi: 10.1007/s10796-017-9774-y.
[45] C. Kim, J. Jahng, and J. Lee, "An empirical investigation into the utilization-based information technology success model: Integrating task-performance and social influence perspective," *J. Inf. Technol.*, vol. 22, no. 2, pp. 152–160, 2007.
[46] T. Zhou, Y. Lu, and B. Wang, "Integrating TTF and UTAUT to explain mobile banking user adoption," *Comput. Hum. Behav.*, vol. 26, pp. 760–767, 2010.
[47] A. Burton-Jones and D. W. Straub, "Reconceptualising System Usage: An Approach and Empirical Test," *Inf. Syst. Res.*, vol. 17, no. 3, pp. 1–49, 2006.
[48] Y. Wand and R. Weber, "Toward a theory of the deep structure of information systems," in *ICIS 1990 Proceedings*, 1990.
[49] Y. Wand and R. Weber, "On the Deep Structure of Information Systems," *Inf. Syst. J.*, vol. 5, no. 3, pp. 203–223, 1995.
[50] T. B. S. Urus, "Living with Enterprise Resource Planning (ERP): An investigation of End User Problems and Coping Mechanisms," Doctoral Degree thesis, RMIT University, 2013.

[51] C. Koo, N. Chung, and H. W. Kim, "Examining explorative and exploitative uses of smartphones: a user competence perspective," *Inf. Technol. People*, vol. 28, no. 1, pp. 133–162, 2015.
[52] J. G. March, "Exploration and exploitation in organizational learning," *March*, vol. 2, no. 1, pp. 71–87, 1991.
[53] E. J. Y. Liew, S. Vaithilingam, and M. Nair, "Facebook and socio-economic benefits in the developing world," *Behav. Inf. Technol.*, vol. 33, no. 4, pp. 345–360, 2014.
[54] V. Venkatesh, J. Y. Thong, and X. Xu, "Consumer acceptance and use of information technology: extending the unified theory of acceptance and use of technology," *MIS Q.*, vol. 36, no. 1, pp. 157–178, 2012.
[55] S. Park, L. Lee, and M. Y. Yi, "Group-level effects of facilitating conditions on individual acceptance of information systems," *Inf. Technol. Manag.*, vol. 12, no. 4, pp. 315–334, 2011, doi: 10.1007/s10799-011-0097-2.
[56] C. Calvo-Porral and M. Nieto-Mengotti, "The moderating influence of involvement with ICTs in mobile services," *Span. J. Mark.-ESI*, vol. 23, no. 1, pp. 25–43, 2019.
[57] B. M. Kalema, "Critical Factors Influencing the Use of Integrated Tertiary Software, T, 2012.," Unpblished Doctoral Degree Thesis, Tshwane University of Technology, South Africa, Pretoria, 2012.
[58] W. H. Delone and E. Mclean, "The DeLone and McLean Model of Information Systems Success: A Ten-Year Update," *J. Manag. Inf. Syst.*, vol. 19, no. 4, pp. 9–30, 2003.
[59] M. C. Bolen and Ü. Özen, "Understanding the factors affecting consumers' continuance intention in mobile shopping: The case of private shopping clubs," *Int J Mob Commun*, vol. 18, pp. 101–129, 2020.
[60] A. Bhattacherjee, "Understanding information systems continuance: an expectation-confirmation model," *MIS Q.*, vol. 25, no. 3, pp. 351–370, 2001b.
[61] M. M. Phahlane, "Multidimensional Framework for Human Resource Information Systems Adoption and Use in a South African University," Unpblished Doctoral Degree Thesis, University of the Witwatersrand, South Africa, Johannesburg, 2017.
[62] S. Salih *et al.*, "The CSFs from the perspective of users in achieving ERP system implementation and post-implementation success: A case of Saudi Arabian food industry," *Sustainability*, vol. 14, no. 23, pp. 1–24, 2022, doi: 10.3390/su142315942.
[63] J. B. Maas, P. C. Van Fenema, and J. Soeters, "Post-implementation ERP usage: A longitudinal study of the impact of Control and empowerment," *Inf. Syst. Manag.*, vol. 35, no. 4, pp. 330–347, 2018, doi: 10.1080/10580530.2018.1503804.

[64] H. Sun, R. T. Wright, and J. Thatcher, "Revisiting the Impact of System Use on Task Performance: An Exploitative Explorative System Use Framework," *J. Assoc. Inf. Syst.*, vol. 20, no. 4, pp. 398–433, 2019.
[65] A. Burton-Jones and O. Volkoff, "How can we develop contextualized theories of effective use? A demonstration in the context of community-care electronic health records," *Inf. Syst. Res.*, vol. 28, no. 3, pp. 468–489, 2017.
[66] F. Brooks, *The Mythical Man-Month. ReadinG*. MA: Addison-Wesley, 1995.
[67] J. S. Jasperson, P. E. Carter, and R. W. Zmud, "A comprehensive conceptualization of the post-adoptive behaviors associated with IT-enabled work systems," *MIS Q.*, vol. 29, no. 3, pp. 525–557, 2005.
[68] F. Carton and F. Adam, "Analysing the impact of the enterprise resource planning systems roll-outs in multi-national companies," *Electron. J. Inf. Syst. Eval.*, vol. 6, pp. 21–32, 2003.
[69] A. Bhattacherjee, "An empirical analysis of the antecedents of electronic commerce service continuance," *Decis. Support Syst.*, vol. 32, no. 2, pp. 201–214, 2001a.
[70] M. Marchand and L. Raymond, "Characterizing, explaining and valuing the effective use of an IT artefact: A field study of performance management information systems in SMEs," in *Proceedings of the 50th Hawaii International Conference on System Sciences*, Hilton Waikoloa Village, Hawaii, US: AIS Electronic Library, Jan. 2017, pp. 5027–5036.
[71] D. E. Campbell and N. Roberts, "Effective use of analytic DSS and job performance: Looking beyond technology acceptance," *J. Organ. Comput. Electron. Commer.*, vol. 29, no. 2, pp. 125–138, 2019.
[72] Department of Higher Education and Training (DHETa), "The Statistics on Post-School Education and Training in South Africa: 2018," Department of Higher Education and Training, 2018. Accessed: Sep. 08, 2019.
[73] Raosoft Incorporated, 2004. Accessed: Nov. 30, 2019. Raosoft Sample size calculator. Available: http://www.raosoft.com/samplesize.html
[74] J. F. Hair, G. T. M. Hult, C. M. Ringle, and M. Sarstedt, *A primer on partial least squares structural equation modelling (PLS-SEM)*. Thousand Oaks: Sage, 2014.
[75] B. Holtom, Y. Baruch, H. Aguinis, and G. A. Ballinger, "Survey response rates: Trends and a validity assessment framework," *Hum. Relat.*, vol. 75, no. 8, 2022.
[76] J. F. Hair, G. T. M. Hult, C. M. Ringle, and M. Sarstedt, *A primer on partial least squares structural equation modeling (PLS-SEM)*, 3rd ed. Thousand Oaks, CA: Sage, 2022.
[77] Statistics South Africa (STATSSA), "Statistic South Africa mid-year population estimates 2019 report," Statistics South Africa. Accessed: Dec. 23, 2023.

[78] J. F. Hair, W. C. Black, B. J. Babin, R. E. Anderson, and R. L. Tatham, *Multivariate data analysis*, 7th ed. Upper Saddle River, NJ: Prentice Hall, 2010.
[79] N. Kock and M. Moqbel, "Social networking site use, positive emotions, and job performance," *J. Comput. Inf. Syst.*, vol. 61, no. 2, pp. 163–173, 2021.
[80] S. M. Maat, E. Zakaria, N. M. Nordin, and T. S. M. Meerah, "Confirmatory factor analysis of the mathematics teachers' teaching practices instrument," *World Appl. Sci. J.*, vol. 12, no. 11, pp. 2092–2096, 2011.
[81] J. Henseler, G. Hubona, and P. Ash Ray, "Using PLS Path Modeling in New Technology Research: Updated Guidelines," *Ind. Manag. Data Syst.*, vol. 116, no. 1, pp. 2–20, 2015.
[82] J. F. Hair, M. Sarstedt, T. M. Pieper, and C. M. Ringle, "The use of partial least squares structural equation modeling in strategic management: A review of past practices and recommendation for future applications," *Long Range Plann.*, vol. 45, pp. 320–340, 2012.
[83] G. Cepeda, C. Nitzl, and J. L. Roldán, "G. Cepeda, C. Nitzl, and J. L. Roldán, "Mediation Analyses in Partial Least Squares Structural Equation Modeling: Guidelines and Empirical Examples, in Partial Least Squares Path Modeling: Basic Concepts, Methodological Issues and Applications, H. Latan and R. Noonan (eds.)," *Springer Cham*, pp. 173–195, 2017.
[84] K. Rouibah, H. I. Hamdy, and M. Z. Al-Enezi, "Effect of management sport, training, and user involvement on system usage and satisfaction in Kuwait," *Ind. Manag. Data Syst.*, vol. 109, no. 3, pp. 338–356, 2009.
[85] H. Sun, "Understanding user revisions when using information system features: Adaptive system use and triggers," *MIS Q. MIS Res. Cent. Univ. Minn.*, vol. 36, no. 2, pp. 453–478, 2012.
[86] P. Haake, S. Schacht, B. Mueller, J. Lauterbach, and A. Maedche, "Toward an operationalization of effective use", European Conference on Information Systems," in *Twenty-Sixth European Conference on Information Systems (ECIS2018)*, Portsmouth, UK: Association for Information Systems AIS Electronic Library (AISeL), Nov. 2018.