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An Enhanced Collaboration Model for Electronic Information Sharing among Yemen Public Universities and YCIT-HE

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ABSTRACT

Objective: Electronic Information Sharing (EIS) is crucial for supporting everyday transactions and decision-making in the higher education sector, enabled by advancements in Information and Communication Technology (ICT). This study aims to develop an Electronic Information Sharing (EIS) model to improve data exchange between Yemen's public universities and the Yemen Center of Information Technology of Higher Education (YCIT-HE). It seeks to address the existing limitations in electronic data exchange, which lead to delays in services and decision-making. **Methods:** The study proposes an EIS model built on three theoretical foundations: Social Exchange Theory (SET), Information Sharing Theory (IST) and Layered Behavior Model (LBM). This model is designed to assist university management in planning and managing the technological, organizational, and environmental aspects of EIS. **Results:** The findings highlight three key dimensions and ten pivotal factors that can significantly enhance EIS between Yemen's public universities and YCIT-HE. **Implications to Research and Practice:** Future research can build on this foundation by testing and refining the proposed model in different educational and organizational contexts. By applying this model, public universities in Yemen can strengthen their collaboration with the YCIT-HE, ultimately improving service delivery and supporting a more efficient higher education ecosystem. The proposed EIS model provides a strategic framework for improving information sharing between public universities in Yemen and YCIT-HE. By addressing critical technological, organizational, and environmental factors, the model can contribute to reducing delays in services and improving decision-making processes.

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Introduction

Electronic Information Sharing (EIS) serves as a valuable resource to enhance decision-making and improve services, whether in a public organization at large or, more specifically, within a public university. Organizations allocate a reasonable budget to establish an optimal sharing environment, especially in emerging economies. In Yemen, for instance, public universities aim to offer cost-effective technical support and high-speed internet, fostering a smooth flow of data and information within and beyond the university (Alameri et al., 2019). Yemen Center of Information Technology of Higher Education (YCIT-HE) represents a cooperative initiative involving the Ministry of Higher Education and universities, aimed at enhancing the higher education sector in Yemen. In the higher education of the Republic of Yemen, EIS offers various advantages to both YCIT-HE and the public universities in many aspects including enhancing information accuracy and timeliness while delivering fast and cost-effective services to both students and public university staff. Albeit a high degree of information sharing, there are limited EIS between Yemen public universities and YCIT-HE. This limitation creates delays in getting services and difficulties making decisions.

YCIT-HE although provides essential services to Yemeni public universities, but there is a lack of effective electronic data exchange between them, causing inefficiencies. The constraint on EIS among government agencies has significant implications for the safety and security of a nation, its citizens, and can pose risks to human lives. Events like the 2004 Big Tsunami, the tragic 9/11 incident in New York, and recent occurrences such as the Turkey earthquake in February 2023 underscore the constraints in information sharing among government entities. In general, the existing reviews of EIS in public sectors have also been relatively limited, presenting opportunities for further exploration in this domain. Notably, there is also a dearth of academic research addressing the factors influencing increased participation in EIS between Yemeni public universities and YCIT-HE, a specific center under MOHESR. The scarcity of scientific investigations into potential internal and external aspects within higher education institutions, focused on enhancing information sharing is also evident.

This study, therefore, endeavors to fill this research gap by concentrating on significant factors and developing a theoretical model to enhance EIS participation within the higher education sector in Yemen, specifically examining information sharing between YCIT-HE and public universities. This study also aimed to contribute to the existing knowledge on EIS by delving into more comprehensive findings within the government sector. The main objective of this study, therefore, was to pinpoint the factors conducive to improving EIS between Yemen's public universities and YCIT-HE.

The study attempted to formulate an EIS framework grounded in Social Exchange Theory (SET), Information Sharing Theory (IST) and Layered Behavior Model (LBM), validating its effectiveness through empirical testing. This comprehensive model integrates factors from individual, environmental, organizational, and technological domains that influence EIS. Structural Equation Modelling (SEM) was employed to validate the model, revealing three dimensions and identifying ten key factors that significantly enhance EIS between Yemeni public universities and YCIT-HE. Notable technological factors encompass IT capability, IT compatibility, information quality, cloud computing, and

social media. Environmental factors include policy and law, along with upper-level leadership. Organizational factors comprise top management support, financial capability, and interagency trust. This model serves as a valuable tool for university management to strategically address technological, organizational, and environmental aspects, guiding the progression and improvement of EIS in the future. Additionally, this study also extends the application of the LBM to understand the behavior of EIS within educational institutions. The study's findings will significantly guide the future implementation of EIS in the education sector, emphasizing the importance of high-quality and efficient services dependent on the quality and availability of information in public universities in Yemen.

Literature Review and Hypotheses Development

Akbulut et al. (2009) found out that government agencies derive various benefits from EIS, including improved services, enhanced access to information resources, greater program efficiency, reduced costs and paperwork, increased data accuracy, and more comprehensive information for decision-making. Effective EIS can also lead to enhanced cooperation among governmental organizations and increased productivity in shared and integrated public service delivery (Bigdeli, Kamal, & De Cesare, 2012, 2013b). YCIT-HE suggests numerous advantages associated with EIS such as cost reduction, time savings, and improved services, enhancing the effectiveness and efficiency of the public university system in Yemen. Moreover, it improves decision-making, thereby enhancing services provided by YCIT-HE to public universities in Yemen. The Ministry of Higher Education in Yemen is keen on improving EIS to better serve public universities (Alsurori & Salim, 2009). Cloud computing is a crucial element that has the potential to significantly enhance information sharing between public universities and YCIT-HE in Yemen. According to Ministry of Higher Education and Scientific Research (2006), a transition to cloud-based information technology can offer substantial benefits, including improved performance, flexibility, reliability, and cost savings.

A fundamental understanding of ICT in education is essential for staying informed about rapidly evolving innovations. In higher education, this knowledge is crucial to develop a strong understanding of how cloud computing is evolving and transforming the educational landscape. Increased information in universities can support decision-makers in making better, quality, and faster decisions (Kamal, Valbir Singh, & Ahmad, 2012). Similarly, increased information in YCIT-HE can help the center provide better services for public universities. Previous frameworks and models have predominantly focused on EIS within the government sector, with insufficient attention given to the higher education sector (Mohammed, Ibrahim, & Mohd Nadzir, 2015). Moreover, there has been a restricted utilization of the Layer Behavior Model (LBM) in research pertaining to Information Sharing, particularly in understanding diverse scenarios of EIS across various organizational levels (Fan, Zhang, & Yen, 2014).

The Layered Behavior Model (LBM) has been previously used in a study of EIS among government agencies (Fan et al., 2014). The model emphasizes four layers: External Environmental, Organizational, Technological, and Individual. The LBM is employed to examine twelve factors aligned with each layer, introducing two new factors, cloud computing and social media, within the Technological layer. Empirical support for these factors signifies an advancement in knowledge and a valuable theoretical contribution to the LBM.

Theoretical Model and Hypotheses Development

The proposed study utilized the LBM and incorporated the principles of SET and IST to analyze the factors impacting EIS between Yemeni public universities and YCIT-HE. These models and theories have been employed in prior studies on EIS (Fan et al., 2014; Sudarman et al., 2022). The proposed study framework is structured into four layers as shown in Figure 1: (i) External Environment layer, (ii) Technological Layer, (iii) Organizational layer, and (iv) Individual layer. Each layer consists of multiple factors.

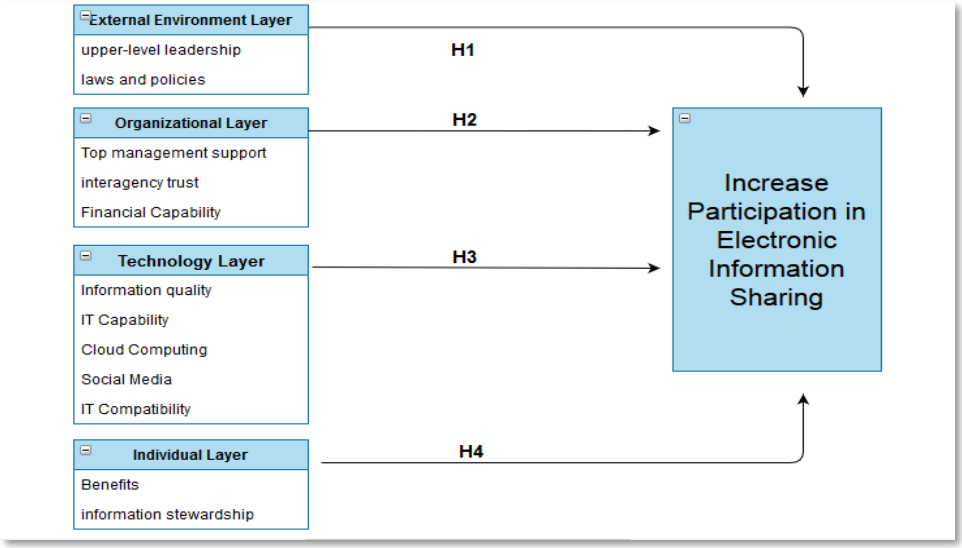

Figure 1: *Hypotheses Development and Theoretical Framework.*

External Environment Layer

In this study, the External Environmental Layer pertains to the impact of external participation beyond the university. Several environmental factors, such as upper-level leadership, have been scrutinized in prior studies by Fan et al. (2014) and Otjacques, Hitzelberger and Feltz (2007), demonstrating the vital role of upper-level leadership in implementing EIS. Upper-level leadership holds the authority to establish guidelines and standards for information sharing, encompassing data definitions, standards, and information clearinghouses (Fan et al., 2014). It can manifest as encouragement or pressure, varying from no encouragement or pressure to recommendations, requests, or offering rewards or imposing penalties (Akbulut, 2003; Perrin & Carrasco, 2023).

Upper-level leadership can exert an interactive influence on public universities in Yemen by setting high standards and goals, fostering ambition, and supporting their attainment. Moreover, a leader's capacity to take risks, explore innovative approaches for the organization and employees, and empower and inspire collaboration are crucial factors (Al-sharafi & Rajiani, 2013; Kouzes & Posner, 2007). Ultimately, motivating employees

contributes to understanding and satisfying their collaborative roles (Al-sharafi & Rajiani, 2013). Laws and policies encompass the rights of government agencies to collect and disseminate information, significantly impacting the encouragement of EIS among agencies. Government policies can either enhance or impede EIS across organizations, particularly in the public sector (Dawes, 1996; Gil-García & Pardo, 2005; Landsbergen Jr. & Wolken Jr., 2001; Ramon Gil-Garcia, Chengalur-Smith, & Duchessi, 2007). The absence of laws and policies safeguarding the privacy and confidentiality of shared information can hinder information sharing in the public sector (Atabakhsh et al., 2004; Landsbergen Jr. & Wolken Jr., 2001; Yang & Maxwell, 2011; Zhang & Dawes, 2006). Policies and laws also bolster agency employers, enhancing authority and trust among staff (Estevez, Fillottrani, & Janowski, 2010; Gil-García & Pardo, 2005; Kamal et al., 2012; Ramon Gil-Garcia et al., 2007). Higher education in Yemen is governed by government-issued laws, policies, and instructions (Alhamassy, 2012; Ojeda et al., 2023). Therefore, in this study, the first hypothesis posits as follows:

Hypothesis 1: *The External Environment Layer could positively impact EIS between Yemeni public universities and YCIT-HE.*

Organizational Layer

In this study, the organizational layer pertains to internal factors within a public university that influence EIS between the university and YCIT-HE. It refers to the awareness, resources, commitment, and governance within an agency that enable the new system to function (Fan et al., 2014). This layer encompasses three factors: Top management support, financial capability, and interagency trust. Top management support involves the endorsement of top managers who can ensure adequate resources and act as change agents to foster a positive atmosphere for staff, encouraging them to share information with other organizations (Kamal et al., 2012). Without top management support, the progress of information sharing can be impeded (Akbulut, 2003; Estevez et al., 2010; Jing & Pengzhu, 2007b, 2009). Top management support provides guidance that helps organizations overcome barriers to information sharing (Akbulut et al., 2009; Liu, Li, & Lu, 2011). In Yemen, top management can support staff by promoting the use of new technology, creating a conducive environment for any new information system (Al-Mamary, Shamsuddin, & Nor Aziati, 2014).

Financial capability refers to the financial capacity required by a local agency for EIS. The cost of EIS is correlated with technology acquisition costs, including development, operating, setup, installation, integration, interfacing, communication, and maintenance costs, as well as staff training costs (Akbulut, 2003; Jing & Pengzhu, 2007b, 2009; Landsbergen Jr. & Wolken Jr., 2001). Organizations with good financial capability can share more information electronically. In Yemen, finance is a significant challenge for higher education, despite a relatively high percentage of public funding. Universities face limitations in funding for running costs, hindering their ability to develop a robust information system platform (Ministry of Higher Education and Scientific Research, 2006).

Interagency trust is defined as a local agency's belief that the state agency will take actions resulting in positive outcomes for the local agency (Fan et al., 2014). Interagency trust is a crucial factor in EIS, influencing proficiency and accuracy among agencies (Kamal

et al., 2012). Trust fosters positive staff behavior and resolves difficulties in interactions arising from differences in departments, values, or fields of operation (Akbulut, 2003; Bigdeli, Kamal, & De Cesare, 2013a; Gil-Garcia et al., 2010). Trust is imperative among staff in YCIT-HE and public universities in Yemen to enhance information sharing and improve services. This study suggests that interagency trust could impact EIS between Yemen public universities and YCIT-HE. Based on this, the second hypothesis of the study was framed as follows:

Hypothesis 2: *The Organizational Layer will positively affect EIS between Yemen public universities and YCIT-HE.*

Technological Layer

The technology layer pertains to the technological context that influences the sharing of electronic information (Fan et al., 2014). This research focuses on several key factors: IT Capability, IT Compatibility, Information Quality, Social Media, and Cloud Computing. The IT Capability, defined as the accessibility of IT resources and expertise within organizations facilitating EIS, is categorized into IT Infrastructure, IT Sophistication, and staffed IT knowledge (Akbulut et al., 2009; Jing & Pengzhu, 2009; Kamal et al., 2012). The adequacy of IT tools plays a crucial role in the adoption of new technologies, with varying IT capabilities in government agencies affecting their attitudes towards information sharing initiatives (Fan et al., 2014; Kamal et al., 2012; Yang & Maxwell, 2011). A lack of IT capability is identified as a significant barrier to information sharing among government organizations, impacting the implementation of new technologies (Bigdeli et al., 2013a; Jing & Pengzhu, 2007a; Lee & Rao, 2007). The skills of agency employees, particularly in mastering new technology, are pivotal in streamlining project development (Barua, Ravindran, & Whinston, 2007). The IT skills of staff and the availability of software and hardware significantly influence EIS within Yemen's public organizations, with the Ministry of Higher Education and public universities demonstrating a positive correlation between increased IT capabilities and enhanced information sharing (Alhamassy, 2012; Alsurori & Salim, 2009).

The IT compatibility, involving equivalent levels of software and hardware across government agencies, is crucial for successful information sharing projects (Bigdeli et al., 2012; Estevez et al., 2010; Liu et al., 2011). Incompatibility in telecommunication networks, software, and hardware, along with unskilled employees, negatively impacts Electronic Information Systems (EIS) among agencies. The next factor of Information quality is considered essential for the success of Management Information Systems (Al-Mamary et al., 2014). Quality information, characterized by attributes like timeliness, accuracy, credibility, and adequacy, enhances departmental cooperation, service delivery, and the overall efficiency of interactions and information sharing (Khasawneh, 2023; Prybutok, Zhang, & Ryan, 2008). Likewise, the Social media factor plays a crucial role in information exchange, acting as a platform for government entities to interact with the public (Cross & Parker, 2004; Hatala, 2006). The use of social media sites in the public sector facilitates outreach, information sharing, and collaboration, contributing to e-Governance objectives.

Finally, Cloud computing, with its potential to enable shared services and information sharing among organizations, particularly in the public sector, is recognized as a valuable

factor in enhancing EIS (Chadha & Bajpai, 2012; Smith, 2011). Certain public sector organizations have adopted cloud computing to enhance service delivery to their customers (Craig et al., 2009; Malliga, 2012; Wyld, 2009). A crucial aspect of cloud computing's potential in the public sector lies in its ability to facilitate the sharing of information and ICT resources among multiple organizations, supporting mobile employees and teleworkers (Hayes, 2008). Additionally, cloud computing provides convenient and swift access to information in an efficient manner for those working in the public sector. Organizations willing to collaborate can arrange shared services within a cloud environment. In the realm of education, cloud computing brings several benefits to e-learning solutions by delivering infrastructure, platforms, and educational services directly through cloud suppliers. This involves leveraging virtualization, centralized data storage, and facilities for monitoring data accessibility (Lubis & Pratama, 2022; Pocatilu, Alecu, & Vetrici, 2010). This study proposes that cloud computing can enhance EIS between Yemen public universities and YCIT-HE. Based on the above discussion, the third hypothesis was framed as follows:

Hypothesis 3: *The Technological Layer will positively impact EIS between Yemen public universities and YCIT-HE.*

Individual Layer

The individual level encompasses the impact of an individual on the utilization of software or any technological project, highlighting how variations in individual talents and skills can influence project performance. This layer examines the influences of participation behavior in EIS between Yemen public universities and YCIT-HE, focusing on two factors: benefits and information stewardship. The first factor of Benefits, within the individual layer, entail significant information sharing among staff in public organizations (Fan et al., 2014; Muthuswamy & Umarani, 2023). The advantages of EIS are identified as a central motivation for achieving organizational objectives in the public sector (Mendes Calo et al., 2012). Various studies indicate that the benefits of information sharing play a crucial role within government organizations and systems (Estevez et al., 2010; Yan, Sun, & Wang, 2009). EIS brings several benefits to organizational staff, including improved information quality, heightened administrative efficiency, cost reduction, minimized duplication of data collection, enhanced information accuracy and timeliness, streamlined operations and management, comprehensive information for problem-solving, support for current information needs, improved decision-making, and the provision of high-quality services in terms of both quantity and quality (Dawes, 1996; Estevez et al., 2010; Jing & Pengzhu, 2007a, 2009; Yang & Maxwell, 2011). The lack of awareness regarding the benefits of information sharing is identified as a significant barrier to staff participation (Seddon, Calvert, & Yang, 2010). Organizational members who are not fully acquainted with the potential benefits of EIS tend to be reluctant to participate. Conversely, awareness of the benefits of EIS has been shown to enhance participation in the higher education sector (Mohammed, Huda, & Maslinda, 2014). Therefore, an increased awareness of the benefits of EIS is expected to stimulate engagement among staff in public universities and employees at YCIT-HE.

Information stewardship factor pertains to information that belongs to all agencies rather than being exclusive to a single entity (Kamal et al., 2012; Kandoli, 2022; Yang, 2011). Dawes (1996) emphasizes the critical role of information stewardship in the success of

interagency information sharing. In the context of information sharing theory, stewardship involves managing information on behalf of others, as information needs to be freely shared among public organizations. Some staff in certain agencies may perceive information as a source of power, leading them to be reluctant in sharing to maintain that power or social influence (Ardichvili, Page, & Wentling, 2003; Kolekofski & Heminger, 2003). The stewardship principle recognizes information as a public good, emphasizing its accuracy, reliability, safeguarding, and security.

The usefulness principle views government information as an asset, with potential benefits derived from proper use. In adhering to these principles, a government assumes roles as a regulator, collector, producer, provider, and user (Center for Technology in Government, 1999). Dawes (1996) underscores the vital role of information stewardship in achieving EIS in public organizations. When organizational participants prioritize information ownership, they may view information as a private resource rather than an organizational one, potentially limiting their willingness to share information seen as beneficial to the entire organization rather than internal competition (Kolekofski & Heminger, 2003; Seidu et al., 2022). Previous studies have demonstrated the significant impact of this factor on EIS. Consequently, this study posits that by considering information stewardship as an influential factor, EIS between Yemen public universities and YCIT-HE can be increased. Based on this, the fourth hypothesis of the study was framed as follows:

Hypothesis 4: *The Individual Layer will positively impact EIS between Yemen public universities and YCIT-HE.*

Methodology

Research Design

The study utilized a quantitative research design to use applications that would help to measure the reliability and validity of the dimensions and identify key factors that significantly enhance EIS between Yemeni public universities and YCIT-HE.

Sampling and Population

Sekaran and Bougie (2016) define population of a study as individuals, objects, or events of interest that a researcher aims to investigate. In this study, the population consisted of six public universities in Yemen, namely Sana'a University, AL Hudaydah University, the University of Aden, Taiz University, Dhamar University, and Ibb University, all of which participated in YCIT-HE. Due to the substantial number of employees in Yemeni universities and due to cost and time constraints, it was impractical to survey every individual in the population. Hence, a sample was chosen from the entire population, as recommended by Hair et al. (2012), who described a sample as a small subset of the population that can reflect the population characteristics. Sampling involves selecting an appropriate number of elements from the target population (Sekaran & Bougie, 2016). The sampling method employed in this study is non-probability sampling, specifically purposive and convenience sampling. Elements for the sample were purposefully selected based on their relevance to the study.

In the proposed study, the sampling frame comprises individuals with roles or tasks related to YCIT services and universities, or those who rely on specific information for decision-making. This includes administrative staff in the chancellery office of each university, faculty deans, system engineers, computer center directors, vice-chancellors, senior management, and student affairs personnel in these six universities.

Data Analysis

To analyze and validate the data, the Smart PLS-SEM (Partial Least Squares-Structural Equation Modelling) software package was utilized. This software is user-friendly for creating structural models, defining necessary statistics, and is particularly convenient for handling complex and large models, as is the case in this study (Baradyana & Ame, 2005). Besides, the measurement model was evaluated based on reliability and validity of the variables of the study. Composite reliability served as the metric for assessing the reliability of these measures which, as recommended by Shook et al. (2004), is a superior option to take into account the standardized loadings and measurement error for each item over the coefficient alpha. The Cronbach alpha values for all constructs were also extracted from composite reliability values and to ensure the internal consistency of the measures.

Results and Discussion

Demographic Profile

Table 1 outlines the background details of the respondents, all of whom are affiliated with academia. It is noteworthy that the basic demographic questions remained consistent and were distributed to all targeted participants. They were requested to provide information about their university affiliation, gender, age, educational qualifications, and the nature of their job roles, including details such as experience, job title, position, and the office or department they worked in. The analysis of the results revealed that the majority of respondents were male (75.1%), with a significant portion falling within the age range of 31 to 40 years (60.1%). Additional respondents were distributed among the age groups of 30 years old (21.4%), 41 to 50 years old (16.2%), and above 50 years old (2.3%).

According to the findings, the majority of respondents were male (75.1%), and a significant proportion (60.1%) fell within the age category of 31 to 40 years. The remaining respondents were distributed across age groups, with 21.4% being 30 years old, 16.2% falling between 41 to 50 years old, and 2.3% being above 50 years old. Regarding educational qualifications, 21.4% reported holding a bachelor's degree, 56.1% had master's degrees, and 18.5% possessed Ph.D. degrees, while 4.0% had other qualifications. All respondents demonstrated sufficient qualifications to respond to the survey questionnaires. In terms of professional experience, 25.4% reported having 1-5 years of work experience, 41.0% had 6 to 10 years, 23.1% had 11-15 years, and 10.4% had 15+ years of work experience. In terms of job roles, 59.0% indicated working in administration, and 41.0% held a combination of academic and administrative positions. Specific roles included 26.0% as general employees, 23.1% as IT engineers, 11.6% as divisional authorities (Responsible), 30.1% as managers, and 9.2% as top management officials in the sampled universities. Table 1 summarizes the demographic profile of the respondents.

Table 1

Demographic Profile of Respondents

Demographic Factor	Category	Frequency	Percentage
Gender	Male	130	75.1
	Female	43	24.9
Age	Under 30	37	21.4
	31 – 40	104	60.1
	41 – 50	28	16.2
	51 or older	4	2.3
Education	Bachelor	37	21.4
	Master	97	56.1
	PhD	32	18.5
	Others	7	4
Experience	1-5 year	44	25.4
	6-10 years	71	41.0
	11-15 years	40	23.1
	Over 15 years	18	10.4
Working Type	Administrative	102	59
	Academic	71	41
Position	Top manager	16	9.2
	Manager	52	30.1
	Responsible	20	11.6
	Employee	40	23.1
	Others	45	26.0
Name of Office	President office	26	15.1%
	Research and development	10	5.8%
	Student Affairs	73	42.5%
	Studies, planning, and follow-up	3	1.7%
	Continuing Education	3	1.7%
	Computer center	42	24.4%
	Engineering Affairs	6	3.5%
	Quality	3	1.7 %
	General Secretariat of the library	2	1.5%
	Studies	4	2.3%

Measurement Model Analysis

In this research, the evaluation of the measurement model relied on the reflective model. The outer model was scrutinized to assess the reliability and validity of the variables employed in this study. Figure 2 illustrates the measurement model, encompassing first-order constructs, second-order constructs, and the corresponding number of items.

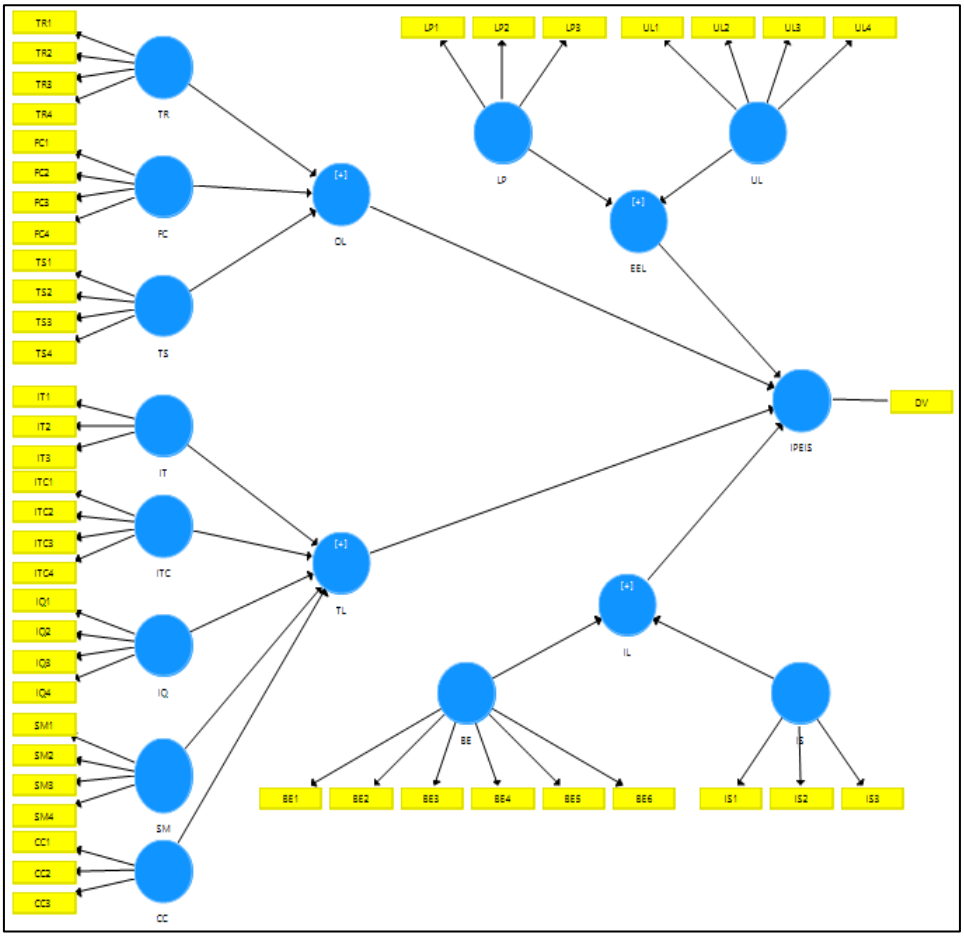

Figure 2: *Measurement Model with Constructs and Indicators.*
Note: UL = Upper-Level Leadership, LP = Law and Policies, TS = Top Management Support, FC = Financial Capability, ITC = IT Capability, TR = Trust, IQ = Information Quality, IT = IT Compatibility, CC = Cloud Computing, SM = Social Media, IS = Information Stewardship, BE = Benefits

Chin, Gopal and Salisbury (1997) asserted that indicator loadings should exceed 0.70, and the significance level should be set at 0.05. At a loading value of 0.70, a latent variable can account for at least 50% of the variance in its indicator. Resampling techniques like jack-knifing or bootstrapping are employed to assess the significance of the loadings. Creswell (2009) recommended that, in the process of eliminating indicators, researchers should adhere to the characteristics of Partial Least Squares (PLS). An indicator should be removed if its reliability falls below 0.70, and its removal enhances the value of Composite Reliability (CR). In this study, all loading values surpass the benchmark of 0.70. Consequently, no indicators are excluded from the measurement. Figure 3 displays the measurement model with the outer loadings of the constructs.

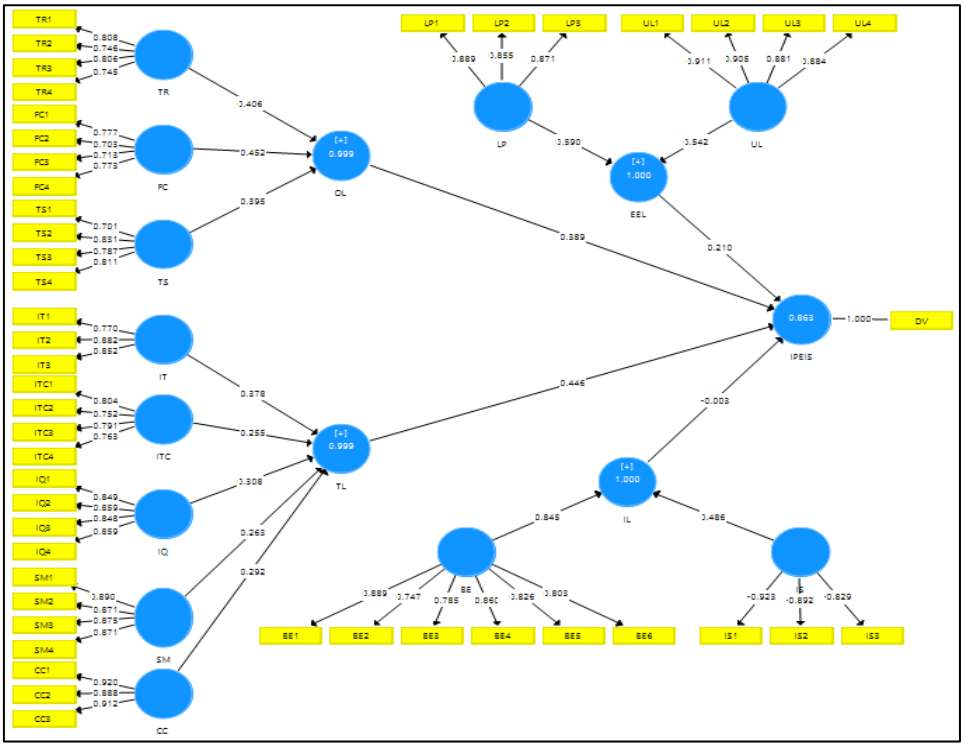

Figure 3: *Measurement Model with Factor Loading.*
Note: UL = Upper-Level Leadership, LP = Law and Policies, TS = Top Management Support, FC = Financial Capability, ITC = IT Capability, TR = Trust, IQ = Information Quality, IT = IT Compatibility, CC = Cloud Computing, SM = Social Media, IS = Information Stewardship, BE = Benefits

Moving forward, the examination of the reliability of reflective measures was undertaken. Composite reliability served as the metric for assessing the reliability of these measures. As proposed by Shook et al. (2004), composite reliability is a superior option as it takes into account the standardized loadings and measurement error for each item over the coefficient alpha. While Cronbach's alpha (α) has certain limitations, such as assuming equal item distribution for reliability, this research employed both criteria to determine the reliability extent. The findings reveal that the Cronbach alpha values for all constructs exceed 0.70, and the composite reliability values for all measures also surpass the benchmark value of 0.70. Hence, the results affirm the internal consistency of the measures.

Hypotheses Testing

In this study, four direct relationships were hypothesized, and the outcome of the structural model indicated that all hypotheses in this study were accepted, with the exception of the relationship between the Individual layer and EIS between Yemen public universities and YCIT-HE.

External Environment Layer:

The statistical analysis revealed a significant role of the external environment layer (β=0.210, $p < 0.000$), thereby supporting the hypothesis. The findings indicate that upper-level leadership can play a crucial role in informing public universities about the advantages and disadvantages of EIS. They can establish rules and standards for information sharing, including data standards, thereby fostering collaboration between YCIT-HE and public universities. The results conclude that upper-level leadership can enhance participation in EIS between YCIT-HE and public universities. To promote EIS, YCIT-HE might consider making recommendations and requests to public universities to share their information electronically.

Accordingly, the findings suggest that YCIT-HE can effectively facilitate EIS by guiding public universities to cooperate and encouraging their employees to share information. Providing guidance and mentoring, particularly from upper-level leadership, is essential for YCIT-HE to understand the staff in universities. If universities are hesitant to share information, this could pose challenges for decision-making bodies in public universities and hinder timely service provision from YCIT-HE. Guiding would be a prudent approach for YCIT-HE to facilitate this exchange.

Concerning law and policy, the findings suggest that public universities can significantly contribute to advancing EIS with YCIT-HE by introducing encouraging laws. Public universities need well-crafted laws and policies, and YCIT-HE must address questions such as: ''How will information be shared by public universities?'', ''Which departments in YCIT-HE are permitted to access information?'', ''Which department in YCIT-HE has the right to collect and own information?'', and ''Which information can be shared?''. Organizing EIS with public universities requires careful planning and execution of policy-making and laws. Additionally, laws and policies can help build trust, reduce risks, and make staff more comfortable in sharing information electronically. Therefore, planning and executing policies and laws related to the electronic information-sharing process through consultation between universities and YCIT-HE can enhance EIS.

Organizational Layer

The findings indicate that the Organizational layer significantly influences EIS between Yemen public universities and YCIT-HE (β=0.389, $p < 0.000$). The impact of top management, interagency trust, and financial capability across public universities on enhancing information sharing was also found to be significant. According to the results, top management should focus on promoting information sharing through electronic means. Top management authorities can facilitate and guide employees for effective and responsive EIS with YCIT-HE. For instance, top management support is crucial to provide the necessary resources and equipment, such as hardware, software, and training, to motivate employees to exchange information with YCIT-HE electronically. Rewards and recognition prospects may also be utilized to motivate employees in this regard. Overall, the findings suggest that management authorities are positive about exchanging information with YCIT-HE.

The result regarding the financial capability factor in EIS aligns with previous studies, highlighting the significant influence of financial capability on EIS among government

agencies (Akbulut et al., 2009). However, YCIT-HE and the Ministry of Higher Education have not increased their expenses for universities in recent years to enhance the education system, partly due to the political situation in Yemen and the cessation of support from organizations like Holland that previously contributed to the center fund. Consequently, universities face challenges in obtaining grants from MOHESR sources to support their EIS. MOHESR is also unable to cover all the costs of new EIS projects for universities. Despite these financial constraints, the findings suggest that financial capability might affect the increase in EIS between YCIT-HE and Yemen public universities. To encourage university participation, one approach is to design cost-effective EIS projects between public universities and YCIT-HE.

Furthermore, this layer emphasizes the substantial impact of the interagency trust aspect. Public university staff believe that a high level of trust with YCIT-HE can enhance EIS. This aligns with a study by Mohammed et al. (2015), which stated that the Ministry of Higher Education and Scientific Research (MOHESR) and public universities are influenced by the trust factor when it comes to sharing information electronically. Many staff members mentioned having a good relationship founded on trust with YCIT-HE. They view YCIT-HE as part of the Ministry, fostering a strong bond built on mutual trust between public universities and YCIT-HE.

Technological Layer

The results indicate that the Technology layer has a significant influence on Increased Participation in EIS (IPIES) (β=0.446, $p < 0.000$, t=8.497), with supporting factors including Information Quality, IT Capability, Cloud Computing, Social Media, and IT Compatibility. The findings suggest that Information Quality is a crucial component for public universities to enhance their electronic exchange of information with YCIT-HE. Universities with high-quality information are more likely to engage positively in sharing information with YCIT-HE. Furthermore, Information Quality contributes to improving trust and maintaining a strong relationship with YCIT-HE.

The study's findings underscore the importance of Information Quality in making informed decisions for the operational excellence of universities. The results confirm that Information Quality is vital for employees working in public sector universities in Yemen, as it reduces processing time, enhances time usability, facilitates effective resource pooling, supports process improvement in the university, and enriches work practices for quality service. The study recommends that universities exchange essential information with meaningful feedback with YCIT-HE. Additionally, the exchange of information should be a two-way process, encouraging YCIT-HE to actively contribute to enhancing participation.

In parallel, the findings of this study conclude that IT Capability significantly influences information exchange between public universities and YCIT-HE in Yemen. Universities should focus on acquiring necessary IT resources to increase information sharing with YCIT-HE. While universities already possess IT infrastructure, advanced resources, such as cloud computing for centralized data storage, may be required. Alongside infrastructure and equipment, IT Capability emphasizes the importance of IT skills in employees. Training and knowledge-sharing, facilitated by top management, can play a crucial role in enhancing IT Capability. The study suggests that IT Capability contributes to the

improvement of the EIS process. Utilizing new technologies, such as cloud computing, with adequate knowledge and understanding allows university employees to be better positioned to share information with YCIT-HE. Providing training and support for smart apps can also significantly contribute to increasing electronic information exchange.

Connected to cloud computing, the findings suggest that public universities in Yemen should plan and implement cloud computing for information storage, access, and distribution in collaboration with YCIT-HE. Storing information on a cloud computing system can enhance EIS between public universities and YCIT-HE. However, access restrictions should be in place to ensure security.

The study highlights the significance of social media in increasing EIS. Social media platforms provide employees with access to information, allowing them to perform official business, engage in professional development, and share information. The study recommends expanding the use of social media platforms beyond WhatsApp and Facebook to include platforms like Twitter, fostering more interaction and information sharing.

Regarding IT Compatibility, the findings suggest that public universities should invest in a robust and compatible infrastructure to facilitate the information sharing process. Implementing hardware, software applications, and non-IT resources can enhance EIS between YCIT-HE and public universities. As technologies for EIS may vary, efforts should be made to design information-sharing systems, focus on IT skills, and enhance knowledge. Collaborative efforts between YCIT-HE and public universities, guided by a thoughtful IT Strategic Plan, can lead to integrated systems, such as a cloud computing platform, promoting effective information exchange. YCIT-HE can play a supportive role by assisting public universities in technology-related matters and guiding them toward viable solutions.

Figure 4 presents the final model of the study. Three layers External Environment Layer, Organizational Layer and Technology Layer, with 10 factors, significantly contributing in increasing EIS between YCIT and Yemen public universities.

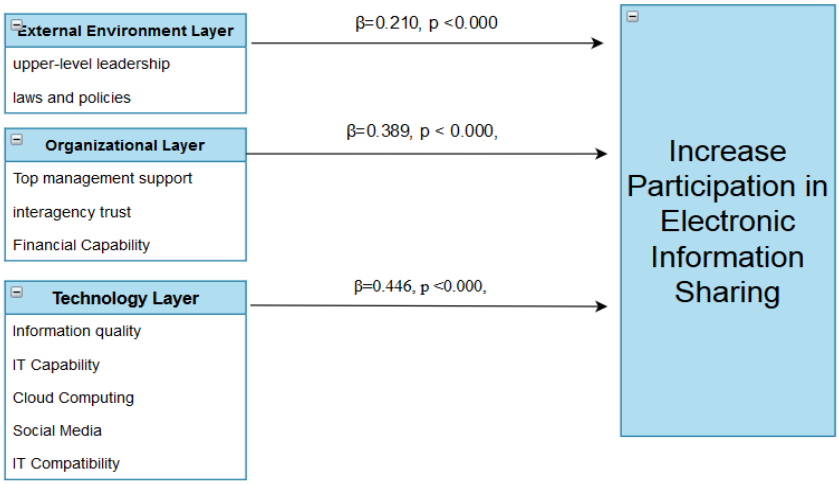

Figure 4: *A Summary of The Survey.*

Conclusion

This study successfully pinpointed the pivotal factors influencing EIS, aiming to bolster collaboration between YCIT-HE and public universities in Yemen. The primary objective was to construct a model facilitating the understanding of factors that wield substantial influence over EIS within the higher education sector in Yemen. Employing the Layered Behavior Model, the model was fashioned to scrutinize the behavior of these factors across different layers. Additionally, hypotheses were formulated based on prior studies to provide rationale for the research model. Questionnaires designed and analyzed in this study were collected from Yemeni public universities, offering a statistical assessment of the theoretical model and research hypotheses.

The findings unveiled EIS factors, broadly classified into technological, organizational, and environmental facets. Ten factors emerged as contributors to the augmentation of EIS between public universities and YCIT-HE. These factors include IT capability, IT compatibility, information quality, social media, cloud computing, financial capability, top management support, upper-level leadership and interagency trust, policy and law. Notably, two factors—benefits and information stewardship—did not receive support in this study. Moreover, the study sheds light on the pivotal role of cloud computing in enhancing EIS between YCIT-HE and public universities in Yemen, offering valuable knowledge and theoretical insights. Armed with the study's results, a comprehensive array of factors was identified, culminating in the proposal of a model for EIS between Yemen public universities and YCIT-HE. These findings substantiate significant contributions to both the ministry and universities, guiding the formulation of impactful strategies that span technological, individual, organizational, and environmental domains—all geared toward fostering heightened participation and utilization of EIS between these entities.

This research presents both theoretical and practical contributions. From the practical perspective, the implications of this research extend to YCIT-HE, public universities, IT managers, decision-makers, policy shapers, and senior university executives. Besides, there are also practical benefits that cascade down to the students and society at large. On practical aspects, this study enriched our understanding of intra-organizational EIS, e-services, e-government, and e-governance in the public sector. In the theoretical landscape it offered a holistic framework, by identifying critical influencing factors, and applying these insights to the specific context of information sharing between public universities and YCIT-HE in Yemen. For instance, it enhanced understanding of information sharing dynamics by investigating the factors influencing EIS between Yemen public universities and YCIT-HE, which deepened the understanding of information sharing framework of public sector and educational institutions. Second, this research also elaborated a comprehensive theoretical framework that incorporates multiple layers, namely External Environment, Organizational, Individual, and Technological layers. This framework serves as a valuable model for analyzing and understanding the complexities of EIS in a collaborative setting.

Third, through empirical analysis, the study identified and established the significance of specific factors, such as top management support, interagency trust, financial capability, information stewardship, information quality, IT capability, cloud computing, social media, and IT compatibility, and contributed to the theoretical foundation of factors

influencing information sharing. Fourth, the research enabled to extend the application of the theoretical framework to the higher education sector in Yemen, offering insights into the unique challenges and opportunities faced by public universities and their collaboration with YCIT-HE. Fifth, the study integrated organizational and technological perspectives of information sharing by examining the interplay between factors like organizational structure, trust, and top management support with technological elements such as IT capability, cloud computing, and IT compatibility. Sixth, the research validated and supported several hypotheses related to the influence of different layers on EIS. This empirical validation strengthens the theoretical framework and provides evidence for the interdependencies among various factors. Finally, this study would expand upon the information stewardship theory by emphasizing the role of individuals in managing and facilitating information sharing. It highlights the importance of considering information as a public good and addresses challenges related to power dynamics and social influence.

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