A Digitization Model for Ugandan Technical, Vocational and Education Training Institutions: An Agency Theory Perspective

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ABSTRACT

Agency theory provides insights into the effectiveness of digitization projects by emphasizing process quality and active monitoring. This study explores how process quality, goal conflict, and communication affect the effectiveness of digitization projects in TVET institutions. Using a pragmatic stance, an abductive approach, and a design science methodology, the research offers a framework for stakeholders to optimize digitization undertakings. Data from 100 participants, analyzed using structural equation modeling, show that process quality significantly enhances communication, predicting project effectiveness. Monitoring serves as a mediator, while an inverse relationship exists between digitization and goal conflict. The study demonstrates high validity and reliability, with all variables having Cronbach's alpha above 0.7. Recommendations include reducing political dynamics and prioritizing process quality to improve outcomes. The findings provide practical guidance for policymakers and practitioners in educational technology integration, especially in developing economies.

KEYWORDS

Agency theory, Digital transformation, Project failure, Uganda’s TVETs, Digitization model

1.0 INTRODUCTION

Countries worldwide invest significantly in Technical and Vocational Education and Training (TVET) due to its essential role in addressing various societal and economic needs (Okolie et al., 2020). TVET is globally recognized for preparing a competent workforce with sophisticated skills to meet the labor market's demands (Amin et al., 2023). TVET programs are essential for sustainable social economic development and global competitiveness, aligning with the evolving needs of industries and economies.

In Africa, TVET facilitates career development in developing economies and prepares graduates for the workforce (Okolie et al., 2020). The focus on career advice and guidance within TVET programs enhances graduates' employability and contributes to the country's skilled workforce (Okolie et al., 2020). Governments and donor agencies, particularly in regions like sub-Saharan Africa and South Asia, have renewed their focus on TVET programs, recognizing their potential to enhance the employability and employment prospects of young individuals in low and middle-income countries (Tripney et al., 2013). TVET also promotes entrepreneurship and drives economic and social change by providing entrepreneurial skills and effectively engaging with partners (Buli & Yesuf, 2015).

The COVID-19 pandemic underscored the need to empower TVET systems, ensuring continuity in education and skills development (Yeap et al., 2021). In Uganda, the Government, led by the Ministry of Education and Sports, has prioritized digitizing TVET operations (ILO, 2021; MoES, 2019) and invested heavily in the digitization of TVET institutions and processes. With the advent of computing technology, many TVET processes are being automated or digitized to enhance efficiency and effectiveness of core operations (Legg-Jack & Ndebele, 2022). This transformation aims to improve how TVETs fulfill their mandate, yet it has encountered several significant challenges.

Despite these investments, digitization projects in Uganda have suffered setbacks similar to other developing economies, with a failure rate of 70%, compared to 66% in developed economies. (Djurovic, 2020; CHAOS, 2020). These failures lead to the waste of already scarce resources. To address this issue, the Government of Uganda approved the Technical, Vocational Education, and Training (TVET) Policy in January 2019 (MoES, 2019). This policy aimed to create a solid foundation for effective implementation by developing standards, procedures, and guidelines (MoES, 2019). A key objective was to promote a flexible, demand-driven TVET delivery system using competence-based modularized packages and ICT integration (MoES, 2019). With significant financial commitment, including a $100 million investment from the World Bank, the government facilitated the purchase of ICT equipment to adapt to modern educational trends (MoES, 2019). However, the transition revealed several issues, starting with conflicting goals between the top management at the Ministry of Education (the principal) and the project implementation teams (the agents). Poor communication within these teams and multiple projects handled by the Project Coordination Unit exacerbated the situation (Lang & Müller, 2021). In some instances, implementation teams withheld information from the principal, creating information asymmetry—a significant obstacle to effective digitization (Confidential, 2021)

To address these issues, communication was proposed as a key construct, including addressing information asymmetry. Another major challenge identified was shirking (Mahaney & Lederer, 2003), where project implementation teams neglected their responsibilities, favoring other activities over the disciplined approach required for effective, successful digitization. Clearly

defining tasks and roles within digitization projects is essential (Lang & Müller, 2021; Mohammadi et al., 2022). Typically, agency relationships involve a contract between the principal and the agent (Eisenhardt, 1989; Mu et al., 2021). In this study, 'contract type' was initially proposed as a construct. However, in Uganda's context, only behavior-oriented contracts were found among the agents, making it impossible to compare them with outcome-oriented contracts. Consequently, 'contract type' could neither moderate nor mediate the relationship between independent variables and digitization.

A novel variable introduced in our study is Process Quality (Carvalho & Sampaio, 2022; Sampaio et al., 2022). This construct includes dimensions such as Monitoring, conducted at both operational and strategic levels, and Top Management Participation. Effective monitoring by top management ensures that every step of the digitization project undergoes thorough checks, enforcing consequences for poor performance and rewards for successful implementation. This rigorous process ensures that only high-quality digitization outcomes are achieved, eliminating duplication and ensuring continuous improvement of processes at every step.

The need for digitization became more critical during the COVID-19 pandemic, as the government found it necessary to offer education services online during lockdowns (Nakaziba & Ngulube, 2024). However, as the demand for digitization grew, implementation challenges manifested, resulting in many project failures. The requirement for the Department to submit quarterly reports on achievements or status of implementation, including challenges and proposed measures, as highlighted in the Auditor General's report on TVET in Uganda, reflects the need for rigorous monitoring and continuous assessment. This emphasizes the broader challenges faced in achieving effective project outcomes, such as those seen in digitization efforts (Audit, 2022).

Emphasizing quality in digitization is crucial, particularly for TVETs with limited resources (Sampaio et al., 2022; Wang & Wang, 2022). These insights highlight the complexities, challenges, and opportunities in the global landscape of digitization, especially in education and development contexts. Countries like Estonia and Finland serve as exemplary cases, showcasing the impact of digitization on their education systems through technological innovations and quality enhancements (Kattel & Mergel, 2019). Estonia is renowned for its technological innovation, while Finland has prioritized digitization since COVID-19 (Bogdandy et al., 2020).

Despite these success stories, global history reveals persistent challenges in digitization, particularly in developing countries like Uganda. Developing economies struggle with a 30% success rate in digitization projects, facing issues like digital exclusion, inadequate monitoring and evaluation, resource misallocation, stakeholder conflicts, and lack of appropriate policies (Drechsler, 2018; Fattah & Setyadi, 2021; Stoica, 2021). Effective communication of organizational change is crucial (Faupel & Helpap, 2020), as $900 billion out of $1.3 trillion spent globally on digitization in 2018 was misallocated (Sun, 2018). Uganda's 70% failure rate aligns with this global trend (Kituyi et al., 2024; Nabulongo et al., 2023), emphasizing the need to focus on critical tasks to achieve effective and successful digitization. Effectiveness in digitization enhances the likelihood of success (Sousa-Zomer et al., 2020), even if success can occasionally occur without an entirely effective process; ideally, both should be achieved. This study will focus on achieving effectiveness (Berman et al., 2024; Türk, 2023).

This study utilizes agency theory to examine the state of digitization in Ugandan TVETs and proposes a model to enhance the effectiveness of digitization projects in these institutions. Previous research relied on a single theory, whereas due to contextual complexity, this study applies a

combination of theories relevant to developing economies, including the DeLone and McLean theory and the Dynamic Capabilities theory (Berman et al., 2024). Additionally, the study recommends minimizing politics and power plays, strengthening stakeholder involvement, and prioritizing process quality over contract types to enhance the success of digitization projects in TVETs.

1.1 Digitization in Uganda

In the context of Ugandan TVETs, the challenges posed by infrastructure limitations and financial constraints are emphasized, presenting significant challenges to effective digitization (Ismail et al., 2022; Oviawe, 2017). Governance issues and policy implementation gaps are noted as factors affecting the successful transition of TVET graduates into the labor market, contributing to the challenges in seamlessly integrating digital technologies into the educational framework (Kintu, 2019). As such, digitization in Ugandan TVETs plays a pivotal role in redefining the learning experience by eliminating complex learning approaches to skilling, and making education more manageable and accessible throughout learners' lives (ILO, 2020). The incorporation of digital tools and technologies in learning and teaching, along with essential training for instructors, is highlighted as a critical need to effectively advance digitization in Ugandan TVETs (Holler et al., 2023; Teis & Christo, 2021). The necessity of digital literacy is emphasized for both learners and instructors to leverage tools effectively, address challenges and improve employability and outcomes in the TVET sector (Ismail et al., 2022).

2.0 THE CASE OF AGENCY THEORY

Agency theory, originating from the challenges posed by the separation of ownership and control in organizations, addresses conflicts between principals (owners/shareholders) and agents (managers/executives) (Jensen & Meckling, 1976). These conflicts often lead to inefficiencies and suboptimal performance of organizations, highlighting the need for effective frameworks to manage principal-agent relationships.

In Uganda, the high failure rates of digitization in TVET institutions stress the need for a more robust approach in implementing these projects. Our research builds on the foundational work of Mahaney and Lederer (2003) to develop a model inspired by successful frameworks from developed countries (Hanna, 2020; Kimuli et al., 2021). By extending their insights on agency theory, we focus on improving communication, reducing shirking, and enhancing process quality to tackle the unique challenges faced in these digitization projects in the Ugandan context.

Agency theory is crucial for navigating the complexities and conflicts inherent in these projects (Djurovic, 2020; CHAOS, 2020). This study examines how these conflicts impact project outcomes, providing valuable insights to improve the implementation and management of digitization efforts within TVETs. By doing so, we aim to create a more effective and sustainable approach to digitization in Ugandan TVET institutions.

Key constructs within agency theory, such as goal conflict, communication, and task programmability, shape project dynamics (Eisenhardt, 1989; Foss & Weber, 2020). Goal conflict emphasizes the need to align project goals, while effective communication promotes collaboration and lessens information gaps. Task programmability ensures clear task definitions for improved alignment, role (for both principle and agent) and goal clarity.

Moreover, integrating insights from Delone and McLean's constructs on Use and User Satisfaction offers a comprehensive view of system usability and end-user perception (Delone & McLean, 1992; Delone & McLean, 2003). Dynamic capabilities theory further emphasizes adaptability and innovation, enhancing resilience in TVET digitization efforts (Teece, 2007).

Strategies proposed by agency theory, such as contracts and governance structures, are relevant in the TVET context (Gwala & Mashau, 2023; Macho-Stadler & Pérez-Castrillo, 2021). Contracts align interests between principals and agents, while governance structures monitor and incentivize positive behavior.

Integrating agency theory into TVET digitization studies aligns with IT governance frameworks (Young et al., 2019), ensuring organizational goal alignment and effective IT management oversight. Processes, relational mechanisms, and structures enforced by top management in government, acting as principals, facilitate goal alignment and enhance project success in TVET digitization initiatives. This integration aims to foster a consistent and sustainable approach to digitization in Ugandan TVET institutions.

2.1 IT GOVERNANCE MODELS AND FRAMEWORKS

In the realm of IT service management, various frameworks such as ITIL Version 4, COBIT, COSO, PRINCE2, and National IT Project methodology offer diverse approaches and practices for managing services and projects. However, when applied to the unique context of Uganda's Technical and Vocational Education and Training (TVET) institutions, these frameworks reveal certain limitations and gaps. This analysis examines the strengths and weaknesses of these frameworks, particularly concerning their alignment with TVET digitization projects and the challenges faced within this educational environment.

ITIL Version 4 offers a wide array of management service practices that can adapt and work with existing frameworks (José et al., 2013; Moudoubah et al., 2021). Its service categorization into areas such as service design and strategy, service operation, service transition, and continuous service enhancement is robust (Nyeko, 2019). However, within Uganda's distinctive educational environment, particularly in TVETs, there is a notable gap: ITIL lacks specific guidance on aligning processes, structures, and relational mechanisms essential for optimal IT-business orientation and alignment (Wulandari & Buliali, 2019), which is necessary for the effective and successful digitization of projects.

COBIT might not singularly meet TVET business and IT alignment needs and is best applied in conjunction with other frameworks (Moudoubah et al., 2021; Zhang & Zhou, 2014), leveraging the strengths of multiple frameworks and addressing various aspects of digitization and control more comprehensively. This framework complexity could overwhelm resource-limited TVET institutions (Mutebi & Ferej, 2023; Okumu & Bbaale, 2019).

The COSO framework lacks quantitative aspects, which are needed to assess and improve project success (Gomes & Romão, 2023) in Ugandan TVETs. Adapting the COSO framework for TVETs may support the improved success of digitization projects (Riyadi et al., 2021), mainly focusing on managing risks and controls comprehensively (Horwath et al., 2012).

The rigid structure and reliance on predefined templates make the Projects IN Controlled Environments (PRINCE2) methodology unsuitable for the dynamic environment within Ugandan TVET digitization projects (COOKE, 2016; Hughes et al., 2017).

The National IT Project methodology, which is tailored for managing IT projects in Uganda, overlooks emphasis on the monitoring of process quality, which is a critical factor for project effectiveness leading to successful digitization. Additionally, its linear approach to IT governance does not align well with the multifaceted and complex nature of digitization projects in these institutions.

In this study, a combination of theories was applied. The combination of Agency Theory, DeLone and McLean's Information Systems Success Model, and Dynamic Capabilities Theory is ideal for guiding successful digitization in Uganda's TVET institutions. Agency Theory aligns stakeholder interests and ensures accountability in project execution. DeLone and McLean's model evaluates system quality, user satisfaction, and impacts of digital systems (DeLone et al., 2018). Dynamic Capabilities Theory promotes organizational agility and innovation for adapting to technological changes (Teece et al., 1997). Integrating these theories provides a robust framework to address the complexities of digitization, offering practical guidance to enhance digital transformation in educational settings. Therefore, a hybrid or customized approach that integrates the strengths of these frameworks while addressing their limitations and incorporating Delone and McLean's constructs and dynamic capabilities theory would be most effective in guiding successful digitization initiatives in Uganda's TVET institutions (Majdalawieh & Khan, 2022; Olaniyi et al., 2024).

2.2 CONCEPTUAL MODEL

Drawing from previous studies (Mahaney & Lederer, 2011), this study introduces a model that addresses gaps in comprehending the relationship between digitization and project success (Joshi et al., 2022), aligning with insights from agency theory that emphasize high-quality, effective organizational processes (Jackson, 2024). The framework incorporates crucial elements, including goal conflict, communication, shirking, task programmability, and contract type, with a central focus on "process quality" as a pivotal mediating influence on the effectiveness of digitization projects in Ugandan TVETs (Berthon et al., 2002; Ozili, 2023).

Drawing inspiration from both the DeLone and McLean theories and the dynamic capabilities theory, the conceptual model herein enhances our understanding of the aspects influencing digitization projects in the TVET context. The framework envisions the improvement of Digitization Projects in Ugandan TVETs through effective IT governance processes (Joshi et al., 2022). In accordance with the agency theory discussed above, the framework emphasizes that for effective digitization projects, principals should prioritize the highest quality in each process (Joshi et al., 2022) managed by agents (Groener & Andrews, 2019; Schoen et al., 2012) with support from top management (the principal). Decision-making at all stages of the transformation process underscores the importance of clear communication in minimizing goal conflicts. This conceptual model, rooted in agency theory principles, provides critical insights for enhancing effective digitization within the unique context of Ugandan TVETs.

Furthermore, task programmability in digitization projects refers to the ability to define and structure tasks in a way that is clear and executable both for top management and managers of project implemention. It involves establishing a systematic approach where tasks are outlined

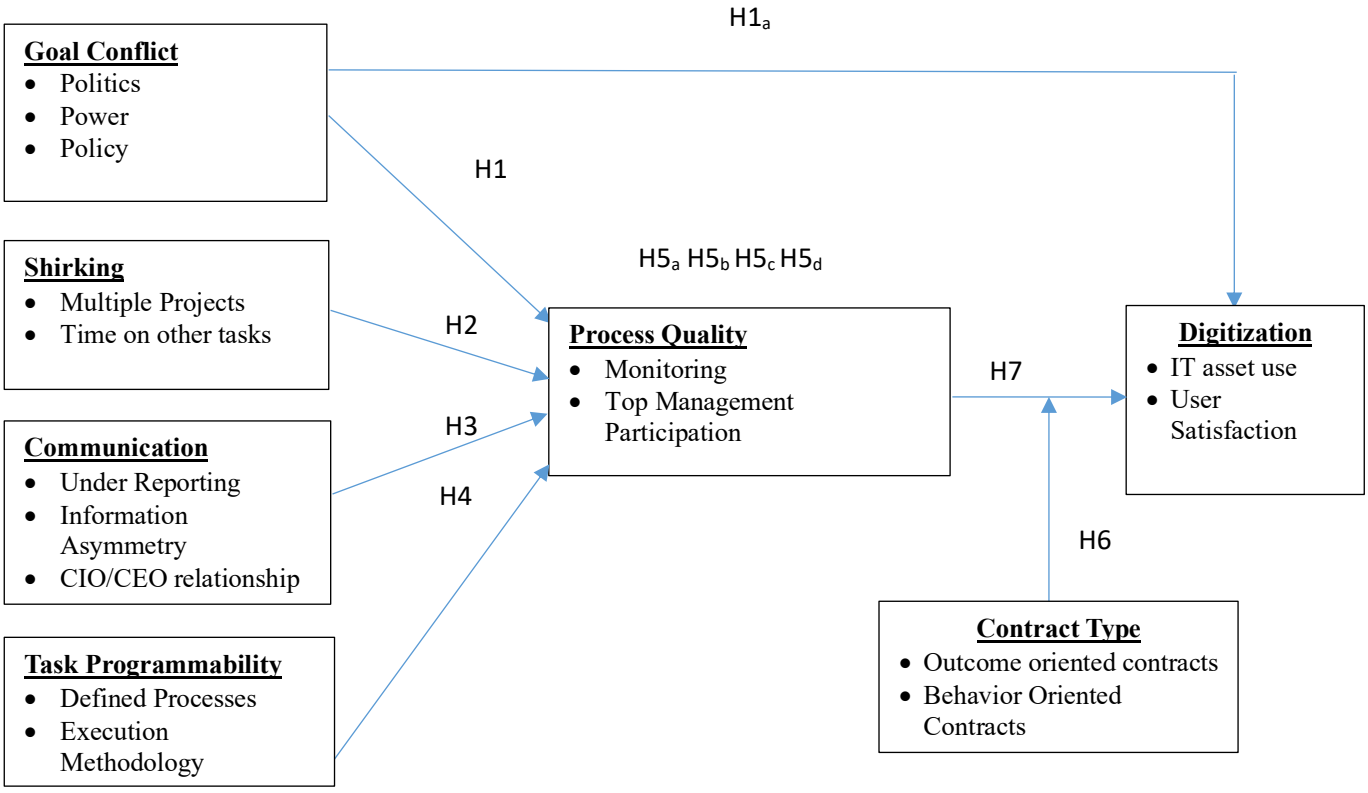

Figure 1: Conceptual model for successful digitization projects derived from Mahaney and Lederer (2003).

comprehensively, including their objectives, timelines, dependencies, and resources required. This clarity allows top management to effectively oversee and monitor progress, ensuring alignment with strategic goals. Simultaneously, it provides implementers with clear directives during the planning phase, enabling them to execute tasks efficiently and with minimal ambiguity. Therefore, task programmability enhances project management by promoting transparency, alignment, and efficiency throughout the digitization process. (Joshi et al., 2020) to remove any form of ambiguity of task implementation.

2.3 RESEARCH HYPOTHESES

The research hypotheses for digitization projects in Ugandan TVET institutions focus on key factors such as goal conflict, shirking, communication, task programmability, process quality, and contract type. These hypotheses, illustrated in the conceptual model in Figure 1, aim to examine the relationships and effects of these variables on the effectiveness of digitization projects. The hypotheses are as follows:

$H1_a$: Goal conflict has a negative significant effect on Digitization Projects in Ugandan TVET Institutions.

$H1_b$: Goal conflict has a negative significant effect on process quality in digitization projects in Ugandan TVET institutions.
$H_{2:}$ Shirking has a negative significant effect on process quality in a digitization project for Ugandan TVETs.
H_3: Communication has a positive significant effect on process quality in digitization in Ugandan TVET institutions.
H_4: Task programmability has a positive significant effect on process quality in digitization projects in Ugandan TVET institutions.
H5a: Process quality mediates the relationship between goal conflict and digitalization in Ugandan TVETs.
H5b: Process quality mediates the relationship between shirking and digitization in Ugandan TVETs.
H5c: Process quality mediates the relationship between communication and digitization in Ugandan TVETs;
H5d: Process quality mediates the relationship between task programmability and digitization in Ugandan TVETs.
H6: Contract type moderates the relationship between process quality and digitization in Ugandan TVETs.
H7: Process quality positively affects digitization projects in Ugandan TVETs.

These research hypotheses are crucial for understanding digitization projects in Ugandan TVET institutions. Taking inspiration from the work of Mahaney and Lederer (2003), the hypotheses outline above are customized to fit the Ugandan context, acknowledging the distinct challenges faced by a developing economy compared to those in developed economies. The hypotheses focus on factors such as goal conflict, shirking, communication, task programmability, process quality, and contract type. Investigating these hypotheses within the Ugandan context provided valuable insights for improving the effectiveness which ultimately could lead to the success of digitization projects.

3.0 RESULTS METHODS

This paper employed quantitative methods to explore the factors influencing the success of digitization in TVET institutions. The quantitative data were analyzed using SPSS v22. This study utilized the Smart-PLS method within structural equation modeling for factor analysis. The research followed a pragmatic approach, using abductive methodology, to refine the conceptual model given the subject and objective nature of the inquiry of this study. Overall, a descriptive field study was conducted to derive a tailored model for enhancing digitization success in TVET institutions.

3.1 RESEARCH DESIGN

This inquiry adopted design science research (DSR) as its research methodology to develop a model for digitization in Ugandan TVETs.

Design science research (DSR) is a methodology that focuses on creating and evaluating artifacts to address specific problems or challenges (Hevner et al., 2004). In the context of this research, DSR was utilized to develop a model for digitization projects in Ugandan TVET institutions. The

methodology involved iterative cycles of relevance, rigor, and design to ensure the creation of a valuable and effective solution (Hevner, 2007; Vom Brocke et al., 2020).

In this study, the DSR relevance cycle begins with identifying the requirements for the design and evaluation of the digitization model (Hevner, 2007). This phase involved conducting a field study to gather insights into the factors influencing digitization in TVETs (Otieno, 2023). The data collected during this phase provided the foundation for understanding the specific needs and challenges faced by TVET institutions in Uganda regarding digitization.

The rigor cycle during this research study emphasized the use of established theories, methodologies, and literature to inform the design process (Hevner, 2007). In this research, theories such as agency theory (Jensen & Meckling, 1976), the DeLone and McLean Information Systems Success Model (Delone & McLean, 1992), and elements of dynamic capabilities theory (Takahashi et al., 2016; Teece et al., 1997) were leveraged to develop a comprehensive and theoretically grounded model. This cycle ensured that the digitization model was not only practical but also aligned with existing knowledge and best practices in the field.

The design cycle in this study involved creating and refining the digitization model for TVET institutions (Hevner, 2007). This phase included designing the model based on the gathered insights and theories (Hevner & Chatterjee, 2021), evaluating the effectiveness of the model through quantitative and qualitative data analysis (Salisu, 2020; Mahaney & Lederer, 2003), and refining it based on feedback from the potential users of the model and empirical evidence from rigorous scientific research (Patton, 1999; Creswell & Clark, 2017; Rupani & Vyas, 2023). The iterative nature of the design cycle allowed for continuous improvement and validation of the model's efficacy in enhancing digitization project effectiveness in TVETs.

Generally, the application of design science research in this study is explained in Figure 1. The design science method used in this study facilitated the systematic development and evaluation of a model tailored to the specific needs and challenges of digitization in Ugandan TVET institutions. By following the principles of DSR, the research ensured that the resulting model was not only theoretically grounded but also practical and effective in addressing real-world digitization issues.

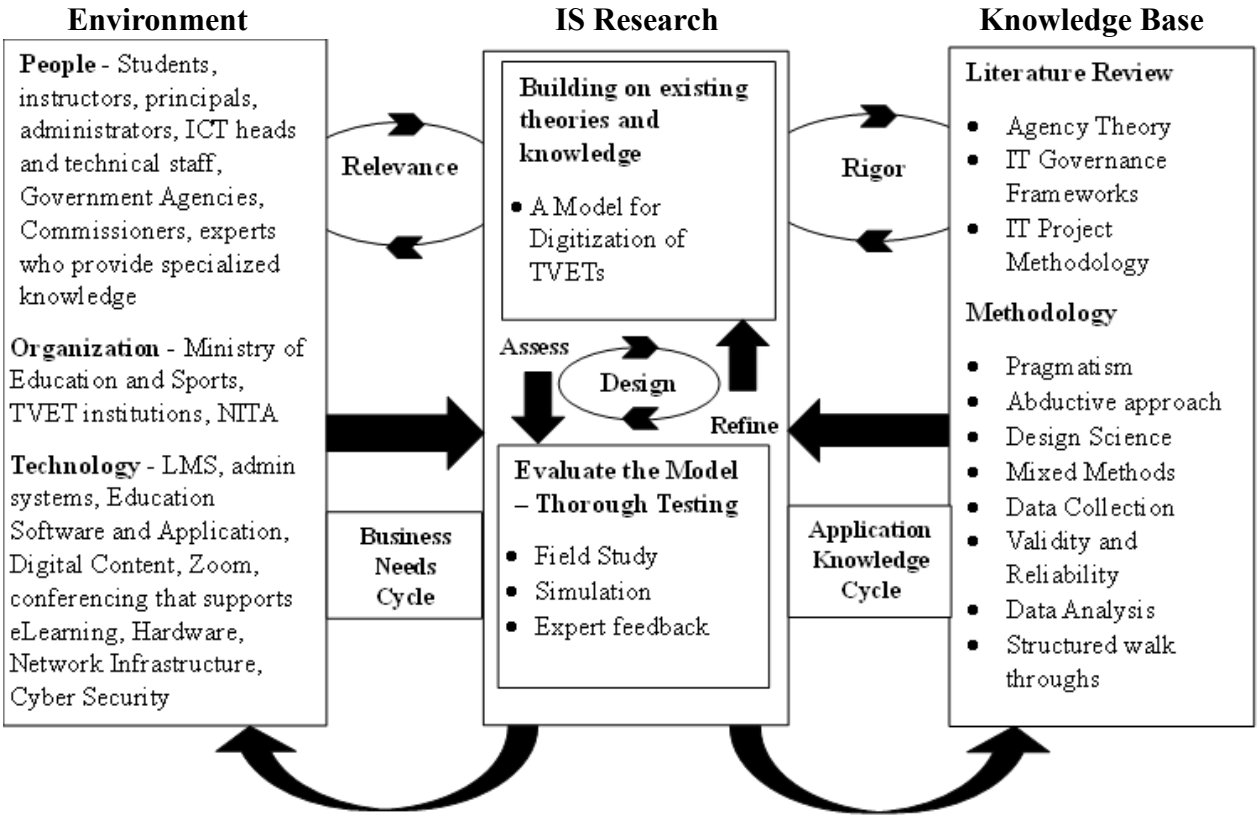

Figure 1: The design science research model adopted from (Hevner et al., 2003; Hevner et al.,2004)

The methodology used in this study aligns with design science research (DSR), which incorporates three essential components: the problem domain, research phases, and knowledge base.

The problem domain, depicted in the left compartment of figure 1, encapsulates the environment of the study focusing on the challenge of improving the success of digitization projects in Ugandan TVET institutions. This domain includes stakeholders such as principals, instructors, ICT heads, administrators, and students who are impacted by the digitization process.

In the middle section of figure 1, which represents the research phases, the study follows the established principles of information systems research, specifically the build and evaluate phases, as outlined by Hevner et al. (2004). The build phase involves designing the model for effective digitization, while the evaluate phase incorporates field studies and structured walkthrough techniques to assess the model's effectiveness.

On the right side of figure 1, the knowledge base signifies the theoretical foundation and methodologies used in the study, drawing from theories such as agency theory (Jensen & Meckling, 1976), the DeLone and McLean information systems success model (Delone & McLean, 1992), and elements of dynamic capabilities theory (Takahashi et al., 2016). These theories and methodologies guided this research process, aiding in both the development and evaluation of the digitization model.

Overall, the designed Model in this study produces theory, practical application, and evaluation methods within the context of information system project research, contributing valuable insights to the field of information systems.

3.2 DATA COLLECTION

The study rigorously explored the effectiveness of digitization projects in Ugandan TVET institutions through a meticulously planned data collection strategy. To ensure comprehensive insights, convenience sampling was used to gather responses from accessible participants, balancing practicality with efficiency. The study employed a purposive sampling strategy to select institutions representing diverse specialties and sizes within the TVET sector, strategically focusing on centers of excellence where digitization investments were concentrated. A structured questionnaire captured perspectives from stakeholders across six designated centers, providing a detailed view of digitization project success. Student participants from technical colleges, where two-year diploma courses are the norm, shared their experiences regarding the use and satisfaction with digitization efforts. The study achieved a high Cronbach's alpha (>0.72) across all survey items, indicating robust internal consistency in measuring user perceptions. Additionally, structured interviews with 177 participants, including Ministry officials, college principals, instructors, and students, further enriched the data. Advanced statistical techniques such as PLS-SEM were employed to analyze quantitative data, while qualitative insights from open-ended interview questions offered deeper understanding of digitization implementation and management within TVET institutions.

3.3 INTERNAL CONSISTENCY

A general discussion of the results in this study are presented in the sections that follow. The table below shows the composite reliability (CR) and Cronbach's alpha (CA) values for the constructs and their variables. Values exceeding 0.70 indicate that the internal consistency standards were met (Hair et al., 2021).

Constructs	**Composite Reliability (CR rho-A)**	**Composite Reliability (CR rho-C)**	**Cronbach's Alpha (CA)**
Criteria	0.818	0.818	0.724
Politics	0.886	0.904	0.872
Power	0.889	0.886	0.831
Counterproductive multitasking	0.93	0.936	0.92
Self-deployment	0.886	0.917	0.855
CEO-CIO Relationship type	0.938	0.940	0.916

Information Asymmetry	0.855	0.871	0.783
Outcome Oriented contract	0.734	0.882	0.732
Behavior Oriented contract	0.92	0.917	0.879
Monitoring & Evaluation	0.963	0.908	0.878
Top Management Participation	0.991	0.929	0.893
IT Resources Usage	0.868	0.909	0.867
User Satisfaction	0.845	0.904	0.839

Table 1: Composite reliability (CR) and Cronbach's alpha (CA) values for the constructs and their variables

4.0 EXPLORATORY AND CONFIRMATORY FACTOR ANALYSIS

Partial Least Squares software was used to carry out exploratory and confirmatory analysis of these data to verify the conceptual framework and to test the hypotheses. Partial least squares (Smart PLS) software was used to facilitate the analysis of the complex relationships between the variables in this study, to tests structural hypotheses, and to provides predictive insights in research models.(Castellanos, 2021).

The results of this study showed that despite the extensive experience of college principals (averaging 15 years), they had limited digitization exposure. This was also detrimental to the amplification of digitization effectiveness and success in these TVET institutions. Table 2 provides the level of education of the respondents in this study.

Highest level of Education	**Frequency**	**Percent%**
Bachelor's Degree	30	30
Certificate	31	31
Diploma	15	15
Master's Degree	16	16
Post Graduate Diploma	7	7

Table 2: Table showing the highest level of education for each of the respondent categories.

The total cost of the digitization effort for digitizing the 12 TVET institutions was over $1,000,000. This study highlighted that most institutions lacked a skilled IT manager or CIO, who is trained and skilled in ICT. In situations where one was present, only one CIO had the requisite ICT skills and had a positive relationship with the CEO, greatly impeding the advancement of digitization,

as revealed in the results of this study. The responsible office for ICT was filled by someone assigned to manage the role without requisite training, as observed in several instances. Table 3 below shows the titles and responsibilities of the respondents in this survey.

Job description	Frequency	Percent%
Academic Registrar	7	7
Commissioner TVET	1	1
Head of Division or Department	19	19
Head of ICT	4	4
ICT Officer Institution	7	7
Institution Principal	7	7
Instructor at TVET institution	8	8
Principal Officer TVET	2	2
Project Implementer	1	1
Project Supervisor	2	2
Student	42	42
Total	**100**	**100**

Table 3: Table showing the titles and responsibilities of the respondents in this survey.

The findings of this study emphasized the pivotal relationship between CIOs and CEOs in influencing digitization outcomes. Moreover, the study revealed that the project implementation team juggled multiple projects simultaneously (Shirking), including construction, agriculture, furniture procurement, vehicle acquisition, and infrastructure refurbishment. Consequently, digitization projects suffered due to limited attention, with construction projects dominating the time and focus of the project implementation team inadvertently.

4.1 Confirmatory Factor Analysis Results for Goal Conflict

The CFA for goal conflict is presented in Figure 4 below. Three factors (power, criteria and politics) were retained after the construct, 'policy', and all its indicators were deleted.

4.2 Reliability and Validity for Goal Conflict

Scores (Cronbach's alpha) above 0.7 were considered satisfactory. To complement Cronbach's alpha, an average variance extracted (AVE) above 0.5 for all factors and a heterotrait–monotrait ratio (HTMT) below 0.85 for each pair of constructs were confirmed.

	Cronbach's Alpha	**CR**	**CR**	**AVE**	**HTMT**	
		rho-A	**rho-C**		**Criteria**	**Politics**
Criteria	0.724	0.818	0.818	0.624		

Politics	0.872	0.886	0.904	0.616	0.494	
Power	0.831	0.889	0.886	0.666	0.562	0.52
Model Fit Indices: SRMR=.0091, d_ULS=.756, d_G=.313, Chi-square=178.257, NFI=.756						

Table 4: Results for Reliability and Validity for Goal Conflict

4.3 Reliability and Validity of Communication

The results in Table 5 show that the AVE for all the factors is greater than 0.5 and that the HTMT ratio is greater than 0.2 but less than 0.85, as was postulated by Henseler et al. (2015).

Table 5 confirms the discriminant validity of the two factors. Furthermore, the SRMR of 0.079 for Communication falls within the acceptable range for the SRMR index, which is between 0 and 0.08 (Hu and Bentler, 1999), showing a good model fit for the measurement model for Communication.

	Cronbach Alpha	**CR**	**CR**	**AVE**	**HTMT**
		rho-A	**rho-C**		Information Asymmetry
CEO-CIO Relationship Type	0.916	0.938	0.940	0.798	
Information Asymmetry	0.783	0.855	0.871	0.695	0.594
Model Fit Indices: SRMR=.079, d_ULS=.173, d_G=.091, Chi-square=57.669, NFI=.870					

Table 5: Results for Reliability and Validity for Communication

4.4 Confirmatory Factor Analysis Results for Contract Type

The CFA for contract type is presented in Figure 6 below. Two factors (outcome-oriented and behavior-oriented) were retained after analysis.

4.5 Reliability and Validity of Contract Type

The results below show that the indicators retained in the summary of the measurement model of contract type guarantee both reliability and validity. Table 6 below shows that for both the outcome and behavior-oriented contract indicators, the Cronbach's alpha value after testing for reliability is greater than 0.7, indicating compliance with internal consistency. These indicators were later found not to be significant when establishing the structural model.

	Cronbach Alpha	**CR**	**CR**	**AVE**	**HTMT**
		rho-A	**rho-C**		Behavior Oriented
Outcome Oriented	0.732	0.734	0.882	0.789	
Behavior Oriented	0.879	0.92	0.917	0.735	0.488

Model Fit Indices: SRMR=.072, d_ULS=.108, d_G=.085, Chi-square=54.420, NFI=.820

Table 6: Reliability and validity measures for contract type

4.6 Reliability and Validity of Process Quality

The results in Table 7 below demonstrate that the indicators retained in the summary of the measurement model of process quality guarantee both reliability and validity.

	Cronbach's Apha	**CR**	**CR**	**AVE**	**HTMT**
		rho-A	**rho-C**		Top Management Participation
Monitoring & Evaluation	0.878	0.963	0.908	0.769	
Top Management Participation	0.893	0.991	0.929	0.813	0.167
Model Fit Indices: SRMR=.079, d_ULS=.152, d_G=.141, Chi-square=92.099, NFI=.746					

Table 5.25: The Reliability and Validity of the Measures for Process Quality

Convergent validity and discriminant validity were assured. The AVE for both factors is greater than 0.5, and the HTMT for both constructs is less than 0.85 (Henseler et al., 2015), which is the threshold for the HTMT ratio. Additionally, the SRMR of 0.077 in Table 5.22 falls within the allowable range for the SRMR index between 0 and 0.08 (Hu & Bentler, 1999).

4.7 Reliability and Validity of Digitization

The results in Table 8 below show that the indicators retained in the summary of the measurement model of digitization guarantee both reliability and validity. Furthermore, the AVE for all factors is greater than 0.5, and the HTMT for the construct pair in Table 8 is less than 0.85.

Table 8: A table showing the reliability and validity of 'Digitization

	Cronbach's Alpha	**CR**	**CR**	**AVE**	**HTMT**
		rho-A	**rho-C**		**IT Resources Usage**
IT Resources Usage	0.867	0.868	0.909	0.715	
User Satisfaction	0.839	0.845	0.904	0.759	0.824
Model Fit Indices: SRMR=.069, d_ULS=.261, d_G=.192, Chi-square=123.372, NFI=.749					

5.0 THE MODEL FOR DIGITIZATION

This section presents a comprehensive model specifically tailored to guide Ugandan TVETs and related organizations through the details of the digitization project journey.

This model incorporates the planning, implementation and transformation phases of digitization. The Task Programmability construct was coded as TP in SPSS, and was measured by 'Having a clear, written methodology for executing the DT project' TP1; 'clear procurement guidelines were followed from start to finish of the DT project' TP2; 'Reliance on clear specifications from IT professionals for DT procurements' TP3. The beta coefficients and the significance of TP1, TP2 and TP3 in this model are shown in Figure 1because there were no specific dimensions in the Task programmability construct.

The Model in Figure 1 integrates established practices from agency theory, theoretical insights from the DeLone and McLean Theory and practical considerations from the dynamic capabilities theory to offer a visual roadmap that Ugandan TVETs and similar organizations can follow.

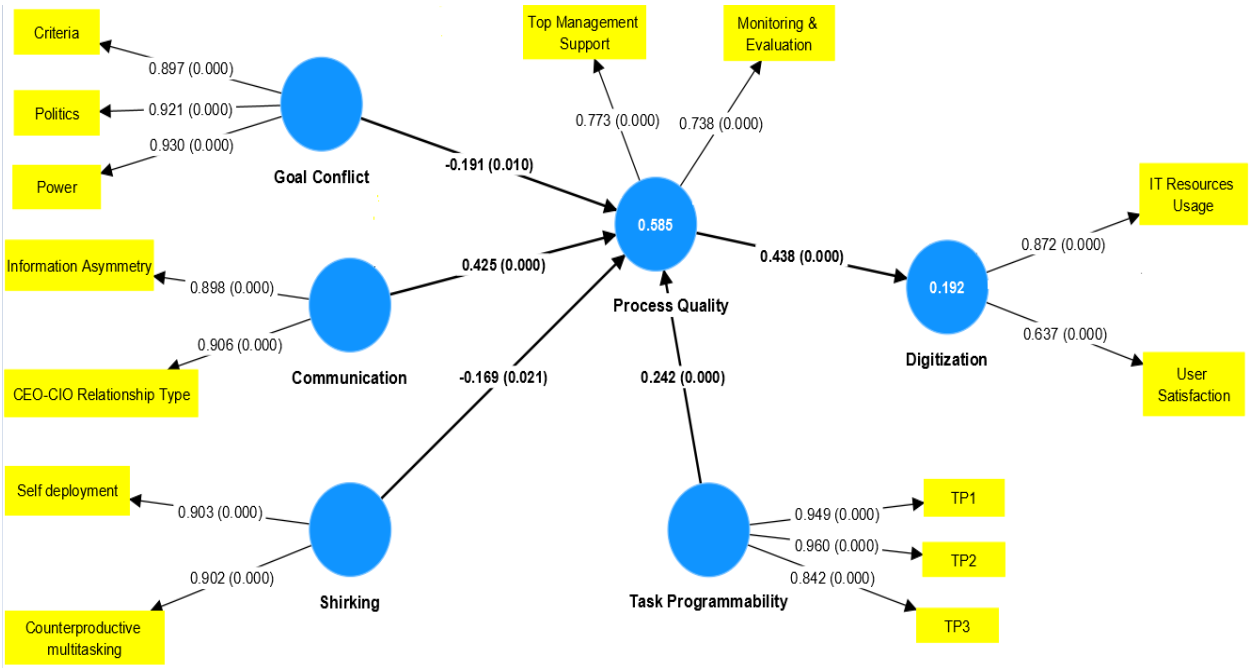

Fig. 1: Model for digitization in Ugandan TVETs.

5.1 Applicability of the model

The digitization model depicted in Figure 1 offers clear guidelines for project execution, presenting a structured framework that outlines principles, best practices, and targeted recommendations to achieve specific objectives effectively. This designed model offers guidelines for effectively implementing digitization projects within Ugandan TVET institutions. The model in Figure 1 is designed to improve future digitization efforts in Ugandan Technical and Vocational Education and Training (TVET) institutions. This model helps to align project goals with the institution's objectives. The model also promotes effective communication and it identifies areas for automation and efficiency. The same model also encourages engagement from all stakeholders, emphasizes continuous progress monitoring of digitization projects, and supports quality

assurance for process quality and continuous improvement of the digitization model through continuous evaluation.

Applying this model systematically provides a structured approach to improving and increasing the chances of better outcomes for digitization projects within TVETs. The model variables assist in decision-making, stakeholder engagement, and resource allocation, ultimately leading to better implementation and positive digitization project outcomes. Furthermore, this projects model is aligned with Dynamic Capabilities Theory (Khin & Ho, 2019). This theory provides opportunities for applicability of this model by providing the ability to leverage emerging technologies and to adapt to evolving digital trends that are relevant to digitization projects. These technologies may include artificial intelligence (AI), machine learning, Internet of Things (IoT), blockchain, cloud computing, augmented reality (AR), virtual reality (VR), and advanced data analytics (Wilden & Gudergan, 2014). These technologies offer capabilities to streamline operations in TVETs, and to enhance decision-making processes among the administrators and managers. Moreover, these technologies can enhance the user experiences of students and lecturers, thereby promoting innovation in service delivery within educational and vocational institutions as they undergo digitization of their core operations (Okumu & Bbaale, 2019). These technologies can promote the ability for the institutions to capitalize on new market demands for education service delivery (Razak et al., 2022). This will happen upon producing graduates for the current and future workforce requirements.

Monitoring project progress ensures that both Ministry top management and operational implementers can oversee the quality of each process involved in digitization, promoting continuous improvement (Carvalho et al., 2020). Enhancing the capacity of both project implementers and management in digitization, coupled with measuring success through key performance indicators (KPIs), improves project outcomes (Feliciano et al., 2021). This approach increases the relevance and practical application of the model in achieving successful digitization project outcomes. Integrating this model into digitization project governance provides institutions with a structured and flexible methodology for project implementation, thereby enhancing the likelihood of effective project execution and positive institutional outcomes for TVETs (Barringer & Harrison, 2000; Gong et al., 2020; Hafseld et al., 2021).

6.0 DISCUSSION OF FINDINGS

This study explored the critical factors influencing digitization projects within Ugandan TVET institutions. While existing literature emphasizes the importance of management engagement in the digitization process, the findings in this study show that operational oversight and task evaluation alone are inadequate for effectively managing digitization projects (Eisenhardt & Eisenhardt, 2018; Thompson, 1967). This study established that Strategic-level monitoring and evaluation emerged as pivotal for digitization projects to thrive. This is in addition to the operational level of monitoring of processes for digitization projects. The findings in this study highlight challenges such as unclear task definitions (inadequate communication), unsatisfactory issue monitoring (process quality), integral internal conflicts (goal conflict), and suboptimal task planning or less than ideal task programmability as key issues to look out for in any digitization project (Mahaney & Lederer, 2003).

Agency theory examines the dynamics between principals (stakeholders or managers) and agents (employees or contractors) within TVET institutions, focusing on how these relationships lead to

conflicts of interest and how tools such as contracts can align these interests to improve institutional outcomes. Contrary to conventional expectations regarding contract types, while traditional outcome-based contracts were found not to significantly influence project outcomes in Ugandan TVET institutions, the study's emphasis on process quality as a means to align interests between principals and agents remains consistent with agency theory principles (Biesenthal & Wilden, 2014; Eisenhardt, 1989). Effective governance mechanisms about contracts, processes, and structures are critical in addressing agency challenges and enhancing project success (Ansell & Gash, 2007; Young et al., 2019).

Structures such as institutional hierarchies, roles, and formal procedures are crucial in TVET digitization projects as they reinforce the operationalization of dynamic capabilities theory (Nambisan et al., 2017; Pesch et al., 2021). These elements facilitate the sensing, seizing, and transforming processes essential for project effectiveness (Sherly & Fianty, 2024; Teece et al., 1997). Institutional hierarchies and defined roles enable effective information flows, ensuring that data pertinent to project progress and stakeholder feedback is efficiently communicated and utilized (Maddaloni & Davis, 2018; Turner & Zolin, 2012). Formal procedures and clear roles empower stakeholders to seize opportunities by defining decision-making authority and resource allocation (Harris et al., 2017; Phillips & Costa, 2007). By so doing, operational efficiency and responsiveness is enhanced (Kortmann et al., 2014). Moreover, these structures manage goal conflicts by providing guidelines for resolving competing priorities and ensure task programmability which is crucial for adapting to changing educational dynamics (Grunefeld et al., 2021). By integrating these structural elements with dynamic capabilities theory, TVET institutions can enhance their agility and strategic responsiveness, contributing to sustainable digitization efficiency.

The introduction of the concept of “process quality" underscores the importance of meticulous execution throughout each project phase. This meticulousness, coupled with effective communication channels leading to a harmonious CEO-CIO relationship, and clearly defined roles and responsibilities, emerged as crucial determinants of effective digitization (Akhtar, 2023; Benlian & Haffke, 2016). Process quality was identified as a critical mediator positively influencing effective digitization projects in Ugandan TVET institutions. Notably, contract type did not exhibit significant influence due to the prevalence of behavior-based contracts across all observed cases.

This study highlights the fundamental role of meticulous task execution, effective communication strategies, notably a harmonious CEO-CIO relationship, and clear role description in achieving effective digitization undertakings within Ugandan TVETs. These findings highlight the comprehensive understanding of operational dynamics and governance practices necessary for advancing digitization efforts in Ugandan TVET institutions.

7.0 CONCLUSION AND RECOMMENDATIONS

This study applied agency theory to identify essential factors for effective digitization and proposed a model tailored to strengthen digitization project processes within educational institutions. Employing design science, a specialized model rooted in agency theory was designed, which is key for advancing effective digitization projects. This study aligns with and builds upon

existing research in the field (Mahaney & Lederer, 2003). It provides insights across various levels and equips project implementers with a framework to understand the challenges and failures of digitization projects in developing economies. Using Ugandan TVETs as a case study, our findings are applicable in diverse contexts.

While monitoring and evaluation are essential for digitization projects, simple operational supervision and monitoring is inadequate. Critical factors identified in this study include unclear roles and responsibilities to agents. The other issues affecting effective digitization include poorly communicated roles and responsibilities in contracts, insufficient monitoring at both operational and strategic levels, internal conflicts between principals and agents (particularly goal conflicts), challenges in CEO-CIO relationships, and shortcomings in task planning.

Clearly defining and communicating roles, and emphasizing "process quality" are pivotal, particularly given the prevalence of fixed-wage contracts in Uganda.

Creating an environment where the Chief Information Officer (CIO) and Chief Executive Officer (CEO) can work well together is critical for the effectiveness of digitization projects. Literature highlights the importance of a synergistic relationship between the CIO and CEO in driving strategic alignment and enhancing overall organizational performance (Karanja et al., 2021; Preston et al., 2008). To achieve this, it is recommended to implement and keep regular communication channels open, joint strategic planning sessions, and mutual goal-setting activities. Studies have shown that such collaborations can significantly improve decision-making processes, ensure the alignment of IT efforts with business objectives, and lessen potential conflicts (Preston et al., 2008). Furthermore, promoting a culture of mutual respect and understanding between these roles can enhance trust and cooperation, which are essential for addressing the complexities of institution digitization (Henderson & Venkatraman, 1993).

Our study challenges conventional assumptions, emphasizing the cruciality of effective communication, the role clarity for the principal and the agent, and the importance of task alignment with the strategic goals of government for digitization in TVETs. Excelling in these areas—communication, roles definition, and task programmability—is central to realizing effective digitization. Prioritizing high-quality processes, promoting a productive CEO-CIO relationship, and addressing conflicts in project goals between principals and agents can significantly mitigate agency problems and alleviate digitization project failures in Uganda, which is the primary objective of our study.

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