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A Model for Digitization Success in Ugandan TVETs: Evaluation Through Structured Walkthroughs and Simulation

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Abstract

This study proposes an information systems model to enhance the success of digitization projects in Ugandan Technical and Vocational Education and Training (TVET) institutions. The research was based on agency theory, with additional insights drawn from the DeLone and McLean Information Systems Success Model and the Dynamic Capabilities Framework. The model was developed based on key constructs such as Communication, Task Programmability, Goal Conflict, Shirking, and Process Quality. To evaluate its effectiveness, a structured walkthrough was conducted using a prototype simulator (SimPro), where expert evaluators assessed its usability, completeness, and performance. Results indicate that 96% of experts rated the model as highly usable, while 92% agreed that it accurately represents key digitization principles. The model's usability significantly influenced expert recommendations for adoption (Spearman's rho = 0.457, p = 0.001). Based on expert feedback, refinements were made to enhance stakeholder engagement, accountability tracking, and task efficiency. These findings suggest that the model has strong potential to improve digitization success rates by enhancing stakeholder engagement, accountability tracking, and task efficiency. Expert evaluators confirmed that these factors are critical to successful digitization in TVETs, indicating that structured implementation of this model could lead to more effective digitization outcomes. However, further empirical validation through real-world implementation is recommended to measure long-term impact.

Keywords: TVET Digitization, Information Systems Model, Structured Walkthrough Evaluation, Task Programmability, Digitization Success Rates, Dynamic Capabilities

INTRODUCTION

Existing frameworks for digitization often assume well-resourced environments with strong institutional structures, making direct application in Ugandan TVETs challenging. Past digitization efforts have faced obstacles such as political interference, inadequate stakeholder engagement, and weak CEO-CIO relationships, leading to inefficiencies and unsustainable implementations. These challenges highlight the need for an adaptive, context-specific approach. This study

employs the rigor cycle within Design Science Research to iteratively refine the model based on empirical findings. The abductive approach enables continuous learning, integrating stakeholder perspectives and institutional dynamics to ensure both theoretical robustness and practical applicability.

Successful digitization projects are essential for improving education systems globally. Countries like Estonia and Finland have demonstrated the transformative potential of technology, with Estonia leading in digital innovation and Finland integrating technology into education, especially during the COVID-19 pandemic [1], [2]. However, despite these advancements, digitization projects continue to face high failure rates globally, particularly in developing economies, where the failure rate stands at 70%, compared to 66% in developed economies [3], [4], [5], . While this 4% improvement in developed economies may seem minor, it highlights the importance of governance, communication, and stakeholder alignment in improving project success and reducing resource wastage [6], [7].

In Uganda, the education sector mirrors global trends, with TVET digitization projects facing a 70% failure rate. TVET institutions play a crucial role in addressing skills shortages and promoting economic growth by offering training in fields such as construction, healthcare, IT, and manufacturing [8], [9], [10]. Despite efforts to integrate e-learning and digital tools, challenges related to governance, communication, and resource allocation persist [11], [12]. These failures underscore the need to enhance process quality, align stakeholders, and establish robust IT governance to ensure the successful implementation of digitization projects in TVET institutions.

A comparative analysis of digitization efforts in various countries highlights relevant strategies, challenges, and opportunities for Uganda's TVET digitization model. In West Africa, governments prioritize digital agriculture to improve productivity and food security, reflecting Uganda's approach of integrating digitization into agricultural education [13]. Similarly, Kenya has made significant investments in digital media and creative economies, which have enhanced employment opportunities and fostered innovation. This approach aligns with Uganda's emphasis on digital skills in TVET programs, where digitalization is considered a key enabler of economic growth [14].

A persistent digital divide in many developing countries remains a key challenge, requiring targeted interventions to ensure equitable digital transformation [15]. Meanwhile, in Central and Eastern Europe, regional cooperation among Visegrad nations, including the Czech Republic, Hungary, Poland, and Slovakia, has accelerated digital ecosystem development. This cooperative approach contrasts with the more isolated efforts seen in some developing nations, including Uganda, where regional digital integration remains limited [16]. Indonesia's "Making Indonesia 4.0" roadmap further highlights the significance of government-backed

policies in promoting digitization, offering valuable insights for Uganda's digitization strategy [17].

Digitization in TVET institutions enhances teaching, learning, and administration by leveraging digital platforms that improve content delivery, skill development, and alignment with industry needs [18]. However, infrastructure limitations, financial constraints, governance challenges, and policy gaps continue to hinder effective implementation [19], [20], [21]. Existing governance frameworks such as ITIL, COBIT, COSO, and PRINCE2 are often too complex and rigid for Uganda's resource-constrained TVET institutions, making them less applicable in this context [22], [23], [24]. These shortcomings highlight the need for a tailored model that addresses the unique challenges of TVET digitization while ensuring process quality, effective governance, and accountability in implementation.

The success of digitization projects in TVET institutions depends on several key factors, each influencing the overall effectiveness and sustainability of digital integration. Communication plays a critical role in ensuring that stakeholders share a common understanding of digitization goals. Poor communication has been identified as a major barrier in 40% of digitization projects, often leading to delays, misinterpretations, and misaligned objectives among project teams and decision-makers [25]. Establishing clear communication structures and ensuring that decision rights and responsibilities are well defined is essential for overcoming these barriers.

Task programmability is another critical factor in the success of digitization efforts. Well-defined and structured tasks simplify oversight and enhance project implementation by providing clear expectations and responsibilities for all stakeholders involved. The clarity of defined tasks not only ensures efficiency but also supports process monitoring and assessment, which are crucial for long-term digitization success [26], [27].

Goal conflict remains a challenge in digitization projects where multiple stakeholders have differing priorities and expectations. Misalignment between agents (project implementers) and principals (institutional leaders) can hinder effective decision-making and result in inefficiencies that negatively impact project outcomes. Addressing goal conflict requires mechanisms that align institutional objectives with stakeholder expectations, ensuring a unified approach to digitization efforts [28], [29].

Shirking, or the tendency of agents to allocate time to non-essential tasks rather than prioritizing digitization initiatives, has been shown to undermine project momentum and process quality. Without clear role definitions, proper accountability mechanisms, and effective performance measurement strategies,

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shirking can significantly delay implementation and reduce the overall impact of digitization projects [30], [31].

Process quality is the cornerstone of successful digitization in TVET institutions. It involves not only adhering to best practices but also adapting workflows to local needs, maintaining consistency in service delivery, and ensuring optimal resource utilization. High process quality enhances strategic alignment between digital initiatives and institutional goals, improving oversight and fostering a culture of continuous improvement in digitization efforts [12].

To address these critical factors and enhance the success of digitization projects, this study proposes a conceptual model. The model extends Mahaney and Lederer's Agency Theory model [32] by integrating constructs from the DeLone and McLean IS Success Model and the Dynamic Capabilities Framework. This integrated approach provides a governance-oriented framework that strengthens stakeholder alignment, communication, and process quality in TVET digitization projects. The conceptual model, illustrated in Figure 1, serves as the foundation for evaluating the effectiveness of digitization efforts in Uganda's TVET institutions.

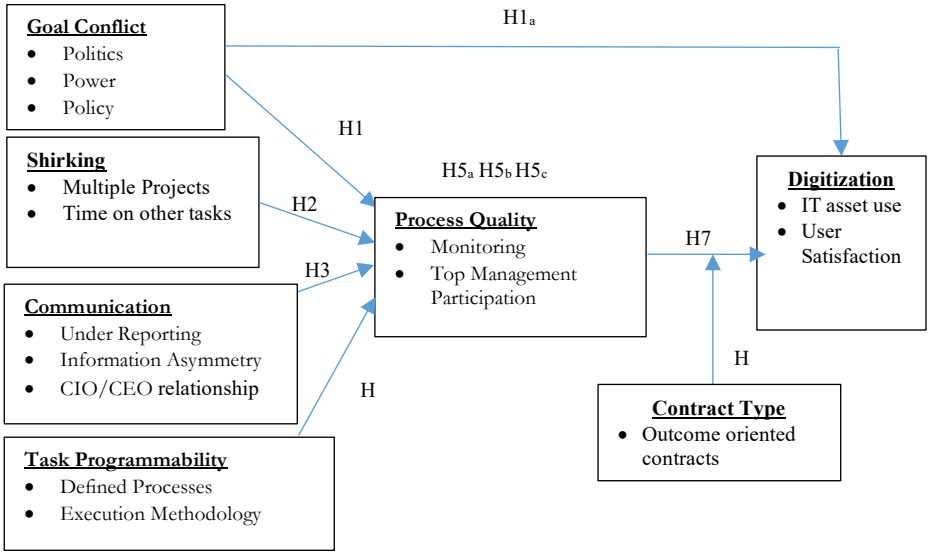

Figure 1. A Conceptual Model for the Digitization of Ugandan TVETs

This study evaluates the proposed digitization model for Uganda's TVET sector, focusing on its usability, efficiency, and effectiveness. The model is designed to improve process quality, strengthen governance structures, and enhance

stakeholder alignment to support the successful implementation of digitization projects.

This study introduces a framework integrating IT governance, process quality, communication, task programmability, goal conflict, and shirking into a model for TVET digitization success. By emphasizing process quality, the model extends the theoretical foundations of Agency Theory, the Dynamic Capabilities Framework, and the DeLone and McLean IS Success Model. These integrations provide a structured governance approach for managing digitization projects [33], [34].

Given the challenges in Uganda's TVET digitization efforts, this study proposes a governance-based approach to digital transformation. The next section details the structured walkthrough and research design, explaining the data collection and analysis methods used in this study. TVET institutions in Uganda face challenges such as ineffective governance and limited resources. This study addresses these issues by introducing a simulation-based approach to enhance digitization success [35], [36], [37]. The next section, discusses the structured walkthrough and the overall research design, detailing data collection and analysis methods used in this study.

2. METHODS

This section presents the research methodology, strategy, and design employed in the study, providing a detailed explanation of how these elements address the research questions. As noted by Al-Ababneh [38], a research methodology serves as a blueprint, guiding the selection and application of appropriate methods to achieve the study's objectives effectively. The Figure 2 illustrates the research process, detailing how the study was conducted and how the developed model was ultimately evaluated.

The study employed a mixed-methods approach to explore factors influencing the success of digitization in TVET institutions. The research process began with problem identification, focusing on challenges in TVET digitization. This informed the development of a conceptual model, which was refined through theoretical integration and empirical validation. Quantitative data were collected using structured questionnaires and analyzed through SPSS v22 for descriptive statistics and SmartPLS for SEM and CFA to evaluate relationships between key constructs such as communication, task programmability, goal conflict, shirking, and process quality. Cronbach's alpha was used to assess instrument reliability [39], while qualitative data from interviews and focus group discussions provided deeper insights, analyzed using thematic analysis in NVivo and word cloud analysis in Google Colab [40], [41].

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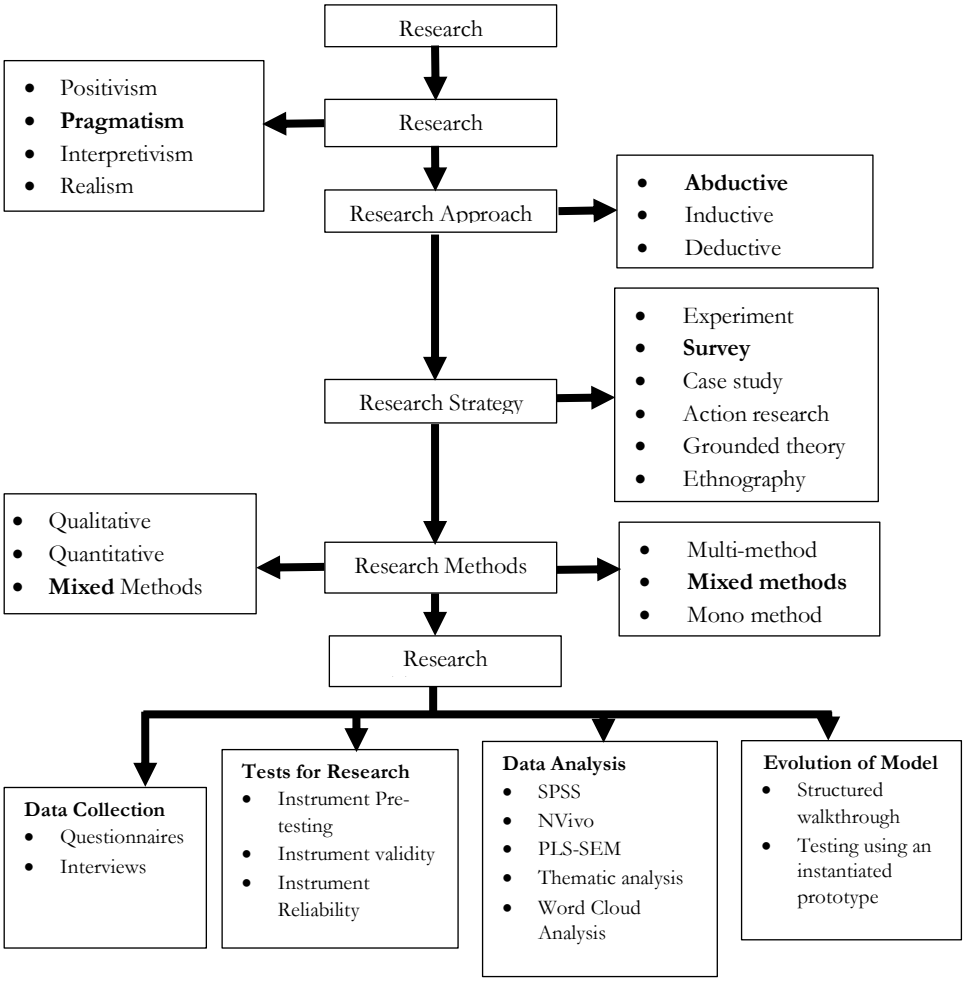

Figure 2. An outline of the Research Methodology used in this study

Guided by a pragmatist stance and an abductive approach [42], [43], the study iteratively refined the conceptual model by integrating Agency Theory, the DeLone and McLean IS Success Model [44], [45], and the Dynamic Capabilities Framework [46] with empirical data from Uganda's TVET digitization context. A field study was conducted in six Centers of Excellence, representing diverse technical specializations, to capture a broad range of digitization experiences [47]. The selection of specific TVET centers was guided by purposive sampling, ensuring a diverse representation of institutions with varying levels of digitization readiness, infrastructure, and administrative capacity. The rationale for this choice was to capture a comprehensive understanding of the challenges and opportunities in

digitization across different TVET environments. Centers were chosen based on geographical diversity, institutional size, government vs. private ownership, and prior engagement with digital initiatives. This approach enhances the transparency and generalizability of the research findings while ensuring the model is applicable across different TVET contexts.

The evaluation of the model was conducted through structured walkthroughs, where 51 purposefully selected experts from TVET institutions, policymakers, and IT professionals assessed the model's usability, completeness, and performance [48][49]. The model was further tested using a prototype simulator [35], which allowed participants to manipulate variables in simulated digitization scenarios. Bivariate analysis revealed that usability significantly influenced adoption likelihood (Spearman's rho = 0.457, p = 0.001) [6]. Feedback from evaluators after using the simulator prototype informed refinements to enhance stakeholder engagement, accountability tracking, and task programmability. These refinements strengthened the model's practical applicability for improving digitization success in Uganda's TVET sector, as further discussed in the findings. This methodology can be used in different education systems [35] and locations by adjusting how data is collected and analyzed. In well-equipped schools, real-world testing can replace simulations, while in areas with fewer resources, simulations work best. The mix of surveys and interviews can also change based on what data is available. These adjustments make the approach useful for different education settings and regions.

2.1 Sampling Strategy

The sampling strategy [50] for the structured walkthrough was designed within the framework of design science research, integrating both quantitative and qualitative methods. The walkthrough involved targeted respondents who provided structured feedback on the model's usability, efficiency, and usefulness. This distinct evaluation approach ensured that the model was assessed by expert stakeholders with direct involvement in digitization projects.

For the broader study, data were collected using purposeful sampling [51] from six TVET Centers of Excellence, which were selected by the government for digitization initiatives. Six TVET Centers of Excellence were chosen for digitization because they were the first to receive UGX 4.8 billion in funding for this effort. These centers were expected to act as models for other TVET institutions, demonstrating how digitization can be implemented effectively when funds become available. Their selection also ensured a diverse mix of technical disciplines and regional coverage, providing a clearer understanding of how digitization works in different settings. Structured interviews in addition were conducted across 12 newly digitized Vocation Technical Institutes that are affiliated to the 6 Technical colleges now known as the centers of TVET excellence in Uganda, involving a total of 177 participants. These participants included

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Ministry of Education and Sports officials, college principals, administrators, technical instructors, IT heads, and students. Of these, 100 responses were found to be suitable for analysis, ensuring that the sample was representative of the diverse specialties and sizes of TVET institutions. These specialties included, but were not limited to, electrical engineering, plumbing, road construction, oil and gas studies, agriculture, and vehicle engineering and maintenance. This diversity ensured that the study captured a broad range of perspectives and experiences in managing digitization initiatives.

The structured walkthroughs focused on a specific subset of 51 participants, carefully chosen for their expertise in modeling, digitization project implementation, and TVET digitization equipment. This purposive sampling approach included PhD students from the College of Computing and Information Sciences at Makerere University (n=6), senior TVET staff from the Ministry of Education and Sports (n=1), and TVET officials from various institutions (n=5). The group also included suppliers and experts in digitization implementation (n=2), principals of technical colleges (n=6), digitization project coordination staff (n=1), ICT staff at TVET institutions (n=5), IT staff at the Ministry of Education Headquarters (n=4), TVET and Planning Commissioners (n=1), administrators of technical colleges and institutions (n=6), and instructors or teachers in TVET institutions (n=14).

The sample size selected for the structured walkthrough was deemed sufficient based on the anticipated diversity of insights and the requirements for evaluating a complex model. This sample size aligns with recommendations from prior research on structured walkthroughs and expert validation studies [52]. Data for the model evaluation were collected using a five-point Likert scale questionnaire that assessed the simulator's usability, success, and performance, with responses ranging from "Strongly Disagree" (1) to "Strongly Agree" (5). This structured evaluation approach provided robust feedback to inform refinements to both the model and the SimPro simulation tool.

2.2 Data Collection

This study utilized a mixed-methods approach [53] for data collection and analysis, incorporating both quantitative and qualitative techniques to evaluate the proposed model and its instantiation through the SimPro prototype.

2.2.1 Main Study

The main field study engaged stakeholders from six Centers of Excellence and 12 newly digitized vocational technical institutes (VTIs) in Uganda. A total of 177 participants, including Ministry officials, college principals, administrators,

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technical instructors, IT heads, and students, were involved in the data collection process. Out of these, 100 responses were considered suitable for quantitative analysis. Structured questionnaires were administered to capture data on project implementation, monitoring processes, user satisfaction, and project goals, providing valuable insights into digitization practices in Uganda's TVET sector.

2.2.2 Structured Walkthroughs

The structured walkthroughs were conducted with a diverse group of stakeholders, including PhD students, university lecturers specializing in information systems, Ministry officials, TVET staff, and digitization experts. These participants provided detailed feedback through a five-point Likert scale questionnaire and open-ended interviews. The structured walkthroughs assessed the usability, success, and performance of the SimPro prototype, with findings directly informing refinements to the model.

2.3 Data Analysis

The main study employed Partial Least Squares Structural Equation Modeling (PLS-SEM) to analyze relationships among variables and test the research model. PLS-SEM was chosen for its strength in predictive analysis and its ability to handle complex datasets. Additionally, descriptive statistics, including means, frequencies, and percentages, were used to summarize key findings in a clear and accessible manner.

The structured walkthrough analysis incorporated both descriptive and bivariate statistical methods. Descriptive statistics provided a quantitative summary of the SimPro prototype's usability, success, and performance, with mean scores, medians, and standard deviations highlighting key findings. Bivariate analysis, including Spearman's rho correlation, explored the relationships between usability, performance indicators, and the likelihood of recommending the simulator. Findings showed that ease of use was a significant predictor of recommendation (Spearman's rho = 0.457, p = 0.001), reinforcing the importance of usability in technology adoption.

2.4 Evaluation of the Model

The model was evaluated by purposefully selected participants through structured walkthroughs and experimentation using SimPro, a prototype simulator designed to test the relationships between model constructs. Evaluators were key stakeholders who were either potential users of the model or directly affected by its implementation. This purposeful selection ensured that participants possessed

relevant expertise and experience, allowing them to provide detailed and actionable feedback for refining the model.

The structured walkthroughs revealed high ratings for the model in terms of usability, completeness, and feasibility. Participants provided constructive feedback, leading to refinements in stakeholder engagement, task efficiency, and accountability tracking. These enhancements culminated in the final version of the model, depicted in Figure 3. The instantiation of the model using SimPro demonstrated its practical utility, confirming its potential to support successful digitization projects in TVET institutions. The next section presents the findings from the structured walkthroughs and the main study.

3. RESULTS AND DISCUSSION

3.1. Model Development

1) Sample Characteristics

Data were collected on the social demographics of each participant, including sex, age, level of education, and years of work experience at the TVET institution. Table 1 provides the detailed specifics of the demographics for each category of participants.

Table 1. Participant demographic characteristics

No	Category	Details
1	Highest Formal Education	31% students (certificate level), 30% bachelor's degree, 15% diploma, 16% master's degree, 7% postgraduate diploma
2	Gender Distribution	69% male, 31% female
3	Digitization Stakeholders	2% Top Management, 76% users/beneficiaries, 14% administrators, 3% project implementation team, 4% quality assurance staff, 1% contract management team
4	Experience in TVET Sector	50% students with 1-5 years engagement, nonstudent participants with more than 5 years' experience
5	Age Distribution	34% (18-25 years), 23% (26-35 years), 21% (36-45 years), 18% (46-55 years), 4% (56-65 years)
6	Job Titles	7% Academic Registrar, 1% Ag. Commissioner TVET, 19% Head of Division/Department, 7% ICT Officer, 7% Institution Principal, 8% Instructor, 2%

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	Principal Officer TVET, 4% Head of ICT, 1% Project Implementer, 2% Project Supervisor, 42% students

2) Derivation of the Model Construction

The model constructs were adopted from Mahaney and Lederer's model [54] for the success of similar projects. The adopted model was extended following a comprehensive analysis of the study's findings in the Ugandan context, which aimed to identify key factors contributing to the success of digitization projects in Ugandan TVET institutions. The survey covered seven main areas: goal conflict, shirking, communication, task programmability, contract type, process quality, and digitization. Goal conflict was identified as a significant factor through the survey responses, which highlighted the need for effective management strategies to handle differing goals among stakeholders. Similarly, shirking emerged as an important construct, as the study aimed to measure deviations from assigned tasks, with varied perceptions suggesting that successful digitization needs to be addressed. Given the high value given by participants, communication was highlighted as a crucial construct, emphasizing its role in project success. Task programmability was included based on positive feedback regarding how well tasks could be predefined and managed, confirming its relevance. The contract type was derived from the varied acceptance levels observed in the survey. Participants' responses indicated that different contract types significantly impact project success, pointing to areas for potential policy improvement. Process quality received positive feedback, emphasizing its importance in enhancing educational and administrative processes. Finally, the study's focus on integrating advanced digital solutions resulted in the overall construct of digitization. Participants' positive evaluations and the significance they attributed to this area stressed its critical role in successful digitization projects. As demonstrated in Table 2, the detailed summary of the derived constructs for this model includes the factors within each construct, the mean scores of respondents on a 5-point Likert scale, and the standard deviations, which illustrate the diversity of perceptions among participants regarding each construct.

Table 2. Summary of Derived Constructs, Factors, Mean Scores, and Standard Deviations

Construct	Factors	Mean Score	Standard Deviations	Notes
Goal Conflict	1. Criteria, 2. Politics, 3. Power	Varies (2.0 to 4.2)	0.8 to 1.4	Diverse perceptions on goal conflict highlight areas for targeted interventions

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Construct	Factors	Mean Score	Standard Deviations	Notes
Shirking	1. Counterproductive multitasking, 2. Self-deployment	2.6 to 3.1	0.8 to 1.0	Moderate acknowledgment of shirking with variations in perceptions, suggesting targeted measures to reduce it
Communication	1. CEO-CIO Relationship, 2. Information Asymmetry	2.8 to 3.2	Low variation	Effective Communication is consistently viewed positively, reinforcing its critical role
Contract type	1. Outcome Oriented Contract, 2. Behavior Oriented Contract	Varies (2.6 to 3.6)	0.9 to 1.3	Diverse contract types.; Outcome-Oriented contracts not observed. Contract type is excluded from the model at this point.
Process Quality	1. Monitoring & Evaluation, 2. Top Management Participation	3.0 to 3.7	1.0 to 1.2	Strong agreement on the effectiveness of process management
Digitization	1.IT Resource Usage 2.User Satisfaction	3.3 to 3.7	0.9 to 1.2	Positive views on digitization indicate strong support for its role in enhancing TVET systems

Table 2 summarizes the key factors evaluated for inclusion in the model supporting digitization projects in Ugandan TVET institutions. The model was developed through a comprehensive study to identify critical constructs contributing to digitization success. These constructs—goal conflict, shirking, communication, task programmability, contract type, process quality, and digitization—were identified through extensive literature review and empirical research.

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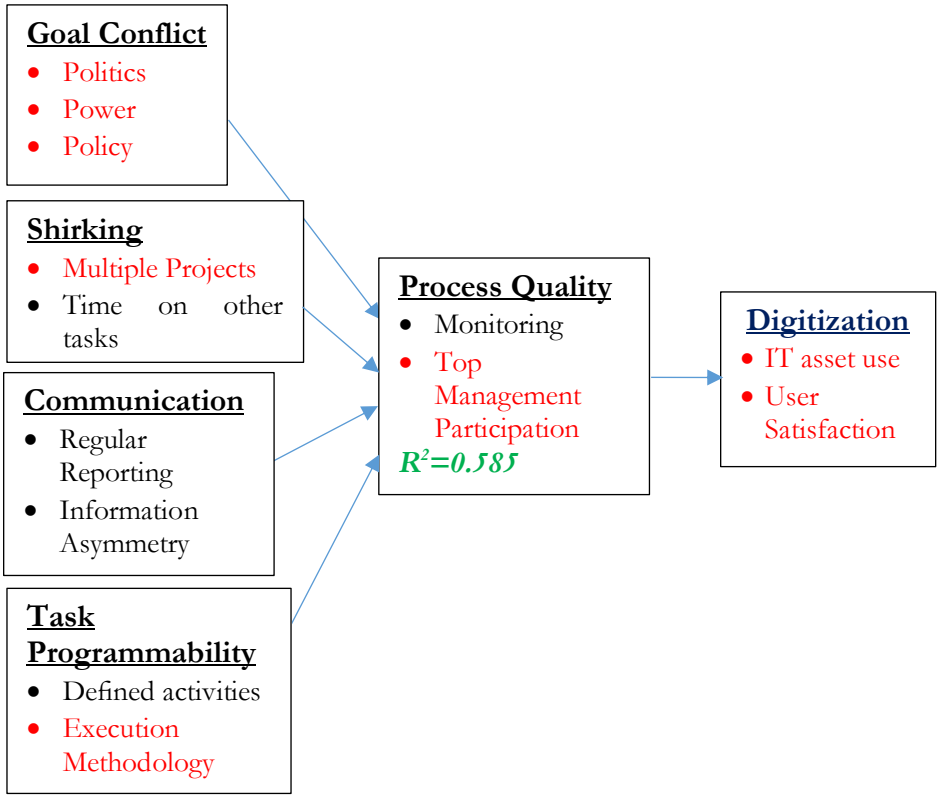

Figure 2. A Model for the Digitization of Ugandan TVETs.

To develop the first version of the model, Partial Least Squares Structural Equation Modeling (PLS-SEM) and SPSS were employed to analyze data collected during the field study. PLS-SEM examined the relationships between constructs, assessed reliability and validity, and evaluated the structural and measurement components of the model. Strong reliability and validity were confirmed through high Cronbach's alpha scores and satisfactory Average Variance Extracted (AVE) values. A favorable Standardized Root Mean Square Residual (SRMR) value of 0.062 further demonstrated the robustness of the model during its design and analysis phase.

The initial iteration revealed that Contract Type did not significantly contribute to the model's fit or explain relationships between Goal Conflict, Process Quality, and Digitization. The Normed Fit Index (NFI) value of 0.409 indicated poor model fit, and the moderation analysis involving Contract Type returned non-significant p-values (e.g., 0.241) for contract type. These findings suggested that Contract Type was not a meaningful moderator, primarily due to the absence of

Outcome-Oriented Contracts in the study. Since all observed contracts were Behavior-Oriented, this limited the construct's relevance. Consequently, Contract Type was excluded following confirmatory factor analysis and further statistical testing.

The refined model demonstrated improved fit and predictive power. The R^2 value for Process Quality was 0.585, indicating that 58.5% of its variance was explained by independent variables such as communication, goal conflict, shirking, and task programmability. This highlights the central role of Process Quality in mediating the relationships between these variables and digitization outcomes, establishing it as a pivotal element in the success of digitization projects in Ugandan TVET institutions. The first version of the model, informed by these analyses and refinements, is illustrated in Figure 1. This representation marks a significant milestone in the study's iterative design process, guided by the principles of design science.

3.2. Evaluation of The Model Through Structured Walkthroughs

This section presents the evaluation of the model conducted through structured walkthroughs, focusing on participant characteristics, the usability and effectiveness of the SimPro prototype, and implications for digitization in Ugandan TVET institutions.

1) Participant Characteristics and Context

The validation dataset revealed critical participant characteristics that informed the evaluation process. Gender distribution showed that 86.3% of respondents were male, highlighting male dominance in ICT-related aspects of the TVET subsector. This trend aligns with statistics from the Uganda Statistical Abstract, which emphasize the male-oriented nature of decision-making despite efforts to promote gender equality.

Educational background was another significant factor. A substantial proportion of respondents (80.8%) held a diploma, bachelor's degree, master's degree, or Ph.D., reflecting a high level of education that facilitated their effective use of SimPro. Conversely, 19.2% had certificate-level training, demonstrating moderate proficiency. This variation underscores the importance of education in effectively engaging with and validating complex systems like SimPro.

The roles of participants within the TVET sector were diverse, ensuring a comprehensive evaluation. Instructors and TVET staff made up 42.6% of respondents, while lecturers and Ph.D. students accounted for 12.7%. Ministry of Education staff in the TVET department contributed 6.4%, and 4.3% were TVET

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students. This diversity provided valuable feedback from stakeholders directly involved in or impacted by digitization initiatives.

2) Results from the Structured walkthrough

At the end of each structured walkthrough session, participants evaluated the Simulation Prototype (SimPro) using a questionnaire. The participants rated statements on ease of use, performance, and effectiveness on a five-point Likert scale. The assessment covered the simulator's usability, accurate representation of the model, alignment with expected outcomes, consistency with research findings, and customizability. The results provided insights into SimPro's overall usability, effectiveness, and performance.

3) Usability

Table 3 shows the rating of statements from the participants on the usability of the prototype (SimPro). The rating is shown as a percentage of the participants who at least agreed that SimPro was usable.

Table 3. The results for usability are shown for the prototype following the prototype validation

Usability Indicators	Percentage of at least Agree
The SDTP Simulator was Easy to use (Qn10)	**96**
The simulator can be easily customized to create specific features of the developed model (Qn11)	**86**
The simulator allows users to manipulate and observe the impact of studied factors in real time (Qn 17)	**86**
The visual feedback mechanisms within the simulator help users track and understand their progress (Qn18)	**96**

The high usability of the SimPro application, derived from the model, suggests that institutions can confidently use it for their digitization projects. Effective change management is crucial in these projects, as supported by the findings of [34]. These studies emphasize the importance of robust change management strategies, including simulations, to ensure successful digitization. Such strategies help manage transitions, align stakeholder expectations, and mitigate the costs and risks

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associated with new digital technologies, leading to smoother and more effective digitization initiatives.

Table 4. Median, mean and standard deviation of the usability measures from participants

Usability measures	Median	Mean ($\bar{x}$)	Standard deviation (σ)
The Simulator was Easy to Use (Assessing ease of use)	4.118	4.0	0.683
The Simulator accurately represents the key components and features of the developed model (Evaluating completeness)	4.137	4.0	0.938
The simulations in SimPro closely align with the expected outcomes based on the developed model (Evaluating completeness and consistency)	4.137	4.0	0.664
The results and outputs generated by the simulator consistently align with the research findings (Evaluating consistency)	4.16	4.0	0.710
The simulator communicates and conveys the principles and insights derived from the research model to users	4.196	4.0	0.633

The review by evaluators showed that users found SimPro user friendly, especially in 'Communication' and 'Consistency', although opinions on 'Accuracy' and 'Capability' varied. This feedback led to updates, improving alignment with user needs. Table 4 shows that "usability" encompasses ease of use, communication, and consistency; "effectiveness" includes accuracy and alignment; and "performance" reflects capability.

4) Effectiveness

Participants rated the effectiveness of the model designed in this study using the SimPro prototype, focusing on its ability to understand, simulate, and predict the success of digitization projects in TVETs. They evaluated whether SimPro accurately reflected the model and included key components of the digitization process. Using a Likert scale, the prototype received high effectiveness ratings, with mean scores between 4.1 and 4.2, indicating consensus on its thoroughness and adequacy. The low standard deviation values (less than 1) further confirmed

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agreement among the expert validators about the model's completeness and ability to guide digitization efforts. Overall, Table 5 shows that participants acknowledged that the SDTP model and SimPro effectively represent essential components for successful digitization project implementation.

Table 5. Effectiveness of the Model using the Prototype (SimPro) when Instantiated

Effectiveness Indicators	Median	Mean ($\bar{x}$)	Standard deviation (σ)	Percentage of at least Agree
The simulator accurately represents the key components and features of the developed model (Qn 11)	**4.00**	**4.14**	**0.948**	**86%**
The simulator effectively captures the realism and fidelity of the scenarios described in the research model (Qn 12)	**4.00**	**4.06**	**0.913**	**82%**
The simulator communicates and conveys the principles and insights derived from the research model effectively to users (Qn 14)	**4.00**	**4.20**	**0.639**	**92%**
The results and outputs generated by the simulator consistently align with the research findings (Qn 15)	**4.00**	**4.06**	**0.935**	**82%**
The visual feedback mechanisms within the simulator help users track and understand the impact of their actions on digitization (Qn 18)	**4.00**	**4.32**	**0.768**	**96%**

5) Performance

Table 6 indicates how participants highly rated the developed model for understanding, simulating, and predicting digitization project success. Ease of use positively correlated with the likelihood of recommending the simulator, while other factors, such as real-time manipulation and visual feedback, did not significantly influence recommendations, likely due to difficulties, by the evaluators when interpreting statistical values.

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Table 6. The significance of the selected performance indicators for the prototype

Performance Indicators	Spearman's rho	P value
The simulator allows users to manipulate the studied factors in real-time	**0.123**	**0.396**
The simulator allows users to observe the impact of studied factors in real time	**0.123**	**0.396**
The visual feedback mechanisms within the simulator help users track and understand their progress	**0.202**	**0.159**
The Simulator was Easy to use	**0.457****	**0.001**
The simulator can be easily customized to create specific features of the developed model	**0.262**	**0.069**

** Correlations significant at 0.01
* Correlations significant at 0.05

The lack of significant impact from features such as real-time manipulation, visual feedback, and customization on recommendations suggests that these features do not heavily influence perceived ease of use or usefulness. Experts prioritize the simulator's core functionalities, such as accuracy and educational effectiveness, which directly contribute to perceived usefulness. If the simulator meets primary needs and expectations, additional features may not significantly alter overall perception. Thus, while these features enhance user experience, their influence on acceptance and recommendation is limited if fundamental usefulness and ease of use are already addressed.

6) Proposed improvements to the Model

During the structured walkthrough, participants identified various usability issues and proposed enhancements to improve the prototype (SimPro). Their suggestions focused primarily on enhancing the layout and appearance of SimPro. These recommendations were duly considered, as outlined below.

Table 7. Comments from the walk-through sessions and researcher actions taken

Comments and Suggestions from Walkthrough Session	Action that was taken
Improve stakeholder communication and engagement throughout the project lifecycle.	The dimension "Stakeholder Engagement" was added to enhance

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Comments and Suggestions from Walkthrough Session	Action that was taken
	stakeholder engagement within the Communication construct.
Simplify task management processes and terminology for better understanding.	Integrated the dimension "Task Efficiency" to streamline and simplify task management processes and terminology within the Task Programmability construct.
Implement mechanisms for accountability and tracking of task deviations.	Implemented "Performance Accountability" as a dimension for Accountability tracking under the shirking construct.
Ensure clarity in project goals and tasks to minimize conflicts.	Added "Goal Definition" as a new dimension to clarify project goals and task definitions under the Goal Conflict construct.
Enhance stakeholder engagement and collaboration to improve overall process quality.	"Collaborative Quality" has been integrated as a dimension under the construct "Process Quality" to improve collaborative process quality.
Conduct a comprehensive feasibility study and involve stakeholders from project inception for successful digitization outcomes.	The new dimension "Feasibility Engagement" was added, focusing on digitization in the Inclusive Feasibility Study and Stakeholder Engagement.
Rename the construct "digital transformation projects" to "digitization projects."	The construct "digital transformation projects" was renamed "digitization projects" to align with the study's focus.

7) Extracted Aspects from Structured Walkthroughs

During the structured walkthrough discussion, participants identified various elements to be integrated into the Model, as detailed in. These suggestions were incorporated into the model through the modifications shown in Table 8.

Table 8. Aspects suggested and derived from the structured walkthrough.

Suggested Aspect	Construct of Interest	Derived Aspect
Enhanced stakeholder communication and engagement	Communication	Improved Stakeholder Engagement
Simplification of task management processes	Task Programmability	Streamlined Task Management

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Suggested Aspect	Construct of Interest	Derived Aspect
Implementation of accountability mechanisms	Shirking	Accountability Tracking
Clear project goals and task definitions.	Goal Conflict	Project Clarity
Improved collaborative process quality.	Process Quality	Collaborative Quality
Comprehensive feasibility study and stakeholder engagement.	Digitization	Feasibility Engagement
Renaming the construct "Digital Transformation" to Digitization	Digitization	Renamed outcome construct as "digitization" to reflect the focus.

3.3. Refining The Model

The model's development in this study followed a structured and iterative approach, with its various stages documented comprehensively in the research report, though not all iterations are explicitly discussed in this paper. Initially, the Generic Model served as the foundational framework. This preliminary iteration was informed by an extensive review of the literature, capturing broad principles and constructs related to digitization. It provided a theoretical base, outlining key dimensions without specific adaptation to the context of Uganda's TVET institutions. The process then progressed to the Conceptual Model, which contextualized the model by Mahaney and Lederer by aligning it with the unique challenges faced by TVET institutions in Uganda. This iteration integrated insights from agency theory, DeLone and McLean's Information Systems Success Model, and Dynamic Capability Theory, bridging theoretical constructs with practical realities in a developing economy. The conceptual model addressed gaps in the generic framework, making it more applicable to the local environment.

Through Confirmatory Factor Analysis (CFA), the model underwent statistical validation to refine its constructs and their interrelationships. This stage ensured that the dimensions proposed in the conceptual model were empirically sound and aligned with data collected during the study. The CFA process played a critical role in shaping the model into a more accurate representation of the factors influencing digitization success. Further refinement occurred after structured walkthroughs, culminating in the refined model, now referred to as the final version shown in Figure 3 below. This iteration incorporated feedback from diverse stakeholders, including information systems experts, PhD peers and users of digitization infrastructure in TVETs.

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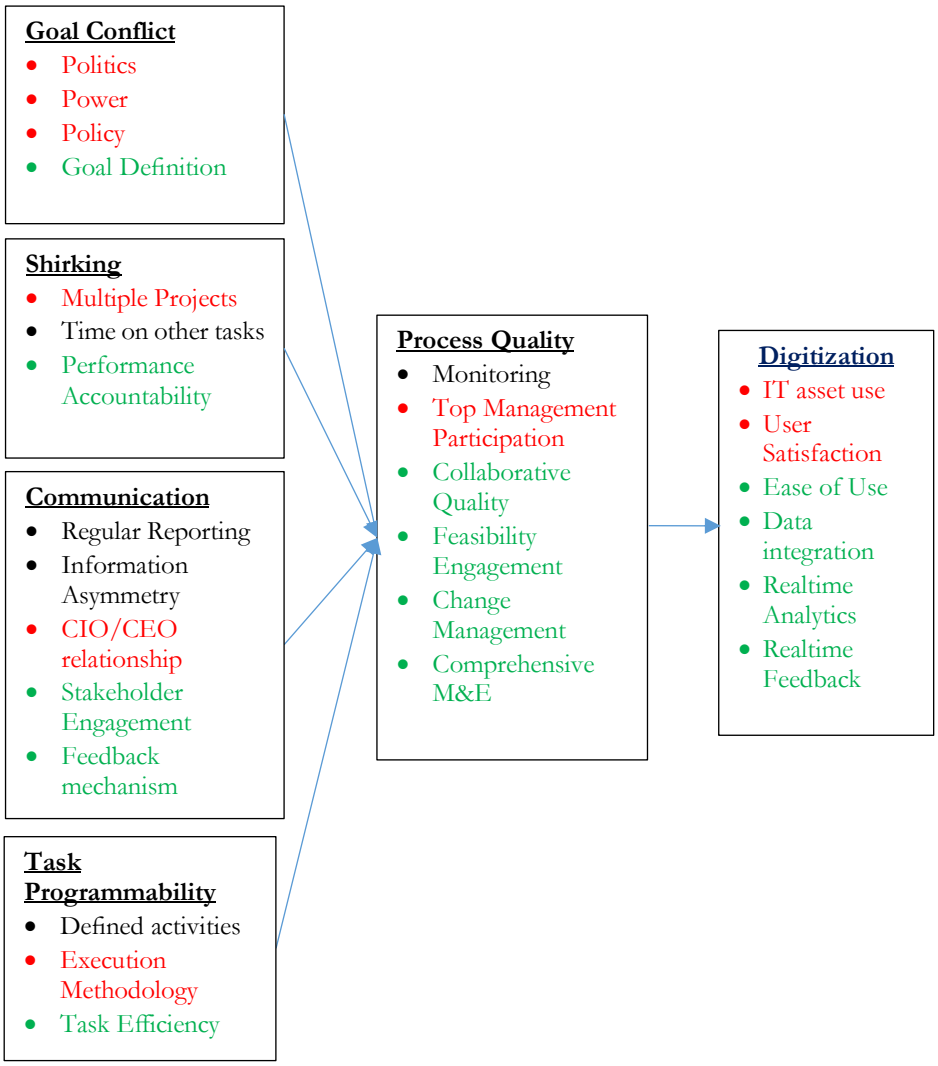

Figure 3. Model after Refinement

Figure 3. The version of the Model after refinement following the walk through experts, TVET specialists, PhD-level peers, and users from TVET institutions. Suggestions from the walkthroughs led to the addition of key dimensions such as Goal Definition, Performance Accountability, Stakeholder Engagement, Task Efficiency, Collaborative Quality, and Change Management. Moreover, the construct previously titled "Digital Transformation Projects" was renamed "Digitization" to better align with the study's objectives and focus. This paper focuses on the final refined model, shaped significantly by the structured walkthroughs and iterative evaluations. These activities provided critical insights

into how the model could be adjusted to better support digitization efforts in Uganda's TVET institutions. Earlier iterations, while not detailed in this paper, were essential to the evolution of the model from a broad theoretical construct to a tailored and practically evaluated tool.

The research report offers a detailed narrative of the model's progression, showcasing how theoretical foundations, empirical analysis, and stakeholder input informed its development. The refined model presented here addresses the specific challenges of digitization in Uganda's TVET sector, ensuring its relevance and practical utility while maintaining academic rigor. The refined model presents the constructs and dimensions essential for supporting digitization projects in Uganda's TVET institutions. The dimensions are categorized to reflect their origins and iterative development. Those depicted in black are adapted from the foundational model and the base theories, including agency theory, DeLone and McLean's Information Systems Success Model, and Dynamic Capability Theory, which informed the conceptual model. Dimensions in red were derived from the detailed literature review conducted during the rigor cycle of the design science research, ensuring theoretical depth. The dimensions in green were incorporated based on insights from the structured walkthroughs and expert evaluations. These additions address gaps identified through stakeholder feedback, enhancing the model's practicality and relevance. The green dimensions directly reflect the aspects suggested by stakeholders, aligning the model more closely with the specific requirements of digitization projects. This iterative refinement emphasizes the model's comprehensive development process and its applicability to both theoretical and practical contexts.

3.4. Discussion

The evaluation of the proposed model for digitization projects in Uganda's TVET institutions, conducted through structured walkthroughs with the SimPro prototype, provided critical insights into the factors influencing successful project implementation. This section discusses the findings of the evaluation, focusing on usability, success, performance, and the refinement of the model based on stakeholder feedback.

1) Usability and Perceived Acceptance

SimPro's usability received positive feedback from participants, with key indicators such as ease of use (96%) and visual feedback mechanisms (96%) rated highly. The simulator allowed users to manipulate studied factors in real time (86%) and track their progress effectively, demonstrating its potential as an accessible and intuitive tool for digitization efforts. These results align with studies emphasizing the importance of user-friendly interfaces in ensuring technology adoption and acceptance [55], [56]. However, while advanced features like real-time

manipulation and customization enhanced the user experience, they had limited influence on the overall likelihood of experts recommending the simulator. Spearman's rho analysis revealed that ease of use was the most significant predictor of recommendation likelihood, with a correlation coefficient of 0.457 (p-value = 0.001). This suggests that users prioritize fundamental aspects such as simplicity and clarity over advanced functionalities, consistent with technology acceptance models [57], [58].

2) Success of the Model

The success of the model, instantiated through SimPro, was evaluated based on its ability to represent the critical components of digitization projects and align with the study's theoretical constructs. Success indicators, including alignment with research findings (82%) and the effective communication of principles (92%), demonstrate the simulator's ability to clearly convey the theoretical constructs and foundational insights of the model, enabling users to understand and apply these concepts in the context of digitization projects. The model's comprehensive coverage of essential factors, such as communication, task programmability, and process quality, highlights its robustness as a model for guiding digitization efforts in TVET institutions [3]. The high success ratings indicate that the model effectively captures the complexities of digitization in the Ugandan context. This is particularly significant given the challenges identified during the study, such as unclear contracts, inadequate task planning, and internal politics exacerbated by poor CEO-CIO relationships. By addressing these challenges through well-defined roles, clear communication, and enhanced process quality, the model provides actionable insights for improving project implementation.

3) Performance and Practical Application

SimPro's performance was evaluated in terms of its functionality and ability to simulate real-world scenarios. Key indicators, such as the ability to manipulate and observe studied factors in real time (86%) and provide visual feedback (96%), were rated positively. However, features like customization and real-time manipulation showed weaker correlations with recommendation likelihood, highlighting the importance of aligning simulator functionalities with user priorities. The study found that SimPro's core capabilities—ease of use and alignment with institutional goals—are critical determinants of its acceptance and utility. This reflects findings from prior research, which emphasize that tools meeting users' primary needs are more likely to be adopted and recommended [6]. By addressing these fundamental requirements, SimPro establishes itself as a practical tool for digitization in TVET institutions.

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4) Refinement of the Model Based on Feedback

The structured walkthrough provided valuable feedback that informed significant refinements to the model. Participants identified gaps in communication, task management, and accountability mechanisms, leading to the addition of new dimensions such as "Stakeholder Engagement" under the communication construct and "Performance Accountability" under shirking. These changes align with the literature, which highlights the importance of clear governance structures, collaborative quality, and proactive stakeholder involvement in ensuring project success [59], [60]. Other refinements included the integration of "Task Efficiency" to streamline task programmability and "Goal Definition" to clarify project objectives, addressing the confusion and conflicts often observed in digitization projects. Additionally, the construct "digital transformation projects" was renamed "digitization projects" to better reflect the study's focus and ensure alignment with stakeholders' expectations.

5) The Role of Leadership and CEO-CIO Relationships

Leadership emerged as a critical factor in the success of digitization projects, with a strong emphasis on the role of principals in guiding and supervising project implementation. The study revealed that poor CEO-CIO relationships, characterized by a lack of collaboration and trust, significantly hindered project outcomes. This finding is consistent with the literature, which stresses the importance of cohesive leadership in promoting effective decision-making and minimizing internal conflicts [61], [62], [63]. Strengthening CEO-CIO relationships was identified as essential for improving communication, aligning goals, and enhancing process quality. By promoting collaboration at the leadership level, institutions can address governance challenges and ensure that digitization projects are executed efficiently and effectively.

6) Process Quality as a Central Component

Process quality, introduced as a new concept in this study, was highlighted as a central mediating factor in digitization success. Participants emphasized the importance of meticulous process execution, clear task definitions, and consistent monitoring in achieving desired outcomes. The study demonstrated that process quality links other constructs, such as task programmability and communication, to overall project success, aligning with findings from prior research [12], [64]. By focusing on process quality, the model addresses gaps in existing models and frameworks. The model also provides a practical approach to managing digitization projects in TVET institutions. The emphasis on high-quality processes reflects the unique challenges of the Ugandan context, where outcome-based contracts are less prevalent, and fixed-wage engagements dominate governance structures [3].

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7) Implications for Digital Policy in Education

The findings from this study provide important insights for shaping digital policy in education, especially in resource-constrained environments. Key challenges such as poor communication, weak leadership collaboration, and lack of stakeholder engagement often hinder digitization efforts. To address this, policies should focus on clear governance structures, ensuring defined roles, accountability, and better coordination between institutional leaders and ICT teams. The study highlights process quality as a major factor in digitization success. Many policies focus mainly on providing technology but overlook workflow efficiency, accountability, and stakeholder collaboration. To improve outcomes, policymakers should integrate task management, performance tracking, and quality assurance measures into national digital strategies.

Leadership and collaboration also play a crucial role. The findings show that CEO-CIO alignment is essential for project success. Education policies should support leadership training programs to equip institutional heads with digital skills and governance expertise, ensuring better coordination of digitization projects. This study also emphasizes the need for context-specific approaches rather than one-size-fits-all models. Many frameworks from developed economies rely on outcome-based contracts, which are not common in Uganda's fixed-wage governance system. Policymakers should adapt models to fit local realities, considering phased implementation and localized stakeholder engagement. Lastly, structured walkthroughs proved effective in evaluating digitization models before full-scale rollout. Governments should adopt similar pilot testing approaches in their digital education policies to ensure that technology investments align with institutional needs before nationwide implementation. These recommendations, if incorporated and adopted by education leaders, could lead to more effective digital policies that are sustainable, and aligned with the realities of TVET institutions and similar education systems worldwide.

4. CONCLUSION

This study evaluated a model designed to enhance the success of digitization projects in Uganda's TVET institutions by addressing key factors such as communication, task programmability, goal conflict, shirking, and process quality. By applying agency theory alongside the DeLone and McLean IS Success Model and the Dynamic Capabilities Framework, the study provided a structured approach to understanding and improving digitization efforts. Findings from structured walkthroughs highlighted that usability, stakeholder engagement, and process quality are key determinants of digitization success. Expert evaluators rated the model highly, with 96% approving its usability and 92% confirming its alignment with digitization principles. The study also demonstrated that ease of use significantly influenced adoption likelihood (Spearman's rho = 0.457, p =

0.001). These results reinforce that clear governance structures, well-defined roles, and process quality are critical for effective digital transformation in education.

The study challenges the traditional reliance on outcome-based contracts, which are often unsuitable for Uganda's fixed-wage employment system, and instead proposes a process-driven approach emphasizing collaborative leadership, structured project oversight, and continuous stakeholder engagement. Strengthening CEO-CIO relationships, improving communication strategies, and integrating task programmability into digitization frameworks are necessary steps for achieving better project outcomes. As global trends in educational technology continue to evolve, this study's findings contribute to the broader discussion on scalable and adaptable digitization models. Emerging technologies such as AI-driven learning analytics, cloud-based education platforms, and digital competency frameworks are shaping future digitization efforts. However, these innovations require strong governance, stakeholder alignment, and process quality to be effectively implemented, especially in resource-constrained environments.

The proposed model provides a structured framework that aligns digitization initiatives with institutional needs, ensuring that investments in educational technology result in sustainable improvements. While the study focuses on Uganda's TVET sector, the insights gained can inform digital education reforms in other developing economies facing similar resource and governance constraints. Countries grappling with weak communication, limited stakeholder engagement, and governance inefficiencies can adapt this model to enhance leadership collaboration, define clear roles, and implement process-driven strategies. Future research should explore longitudinal studies and real-world implementation to measure the long-term impact of this model. As digital transformation in education expands, prioritizing structured implementation frameworks alongside technological advancements will be key to ensuring meaningful and effective digitization in education systems worldwide.

4.1. Limitations and Constraints of The Study

The study's data collection phase was conducted within a defined three-month period, which may have influenced the comprehensiveness of the data gathered. Additionally, the research focused specifically on the TVET subsector in Uganda, targeting six centers of excellence and affiliated vocational technical colleges that had received funding for digitization initiatives. This targeted scope may limit the generalizability of the findings beyond similar contexts. The assessment of variables was confined to the TVET subsector, reflecting the study's focus on this specific domain. Broadening the scope to include a wider range of stakeholders and institutions, including those outside the education sector, could provide additional insights and enhance the applicability of the findings. Future research

incorporating other sectors and institutions implementing digitization initiatives could yield more comprehensive results.

4.2. Ethical Considerations

This study adhered to ethical standards guided by the Design Science framework [65]. Ethical approval was obtained from the Mildmay Uganda Research Ethics Committee, the Uganda National Council for Science and Technology, and the Ministry of Education and Sports. Participants' confidentiality and rights were respected, with voluntary participation and the option to withdraw at any time. Participants included national-level TVET supervisors, policymakers, IT managers, project implementers, TVET instructors and students from technical colleges, selected based on inclusion criteria to ensure relevance to TVET processes. Exclusion criteria aligned with Uganda's newly approved TVET Policy Agenda. Health risks, including COVID-19 and Ebola, were mitigated through strict protocols such as temperature checks, hand hygiene, mask-wearing, and minimizing equipment sharing. Confidentiality was maintained using participant codes, and data were securely stored for research purposes. The study, self-funded by the researcher, covered all costs, including refreshments for participants. While no monetary compensation was provided, transport refunds facilitated participation in focus group discussions. Findings were disseminated through a comprehensive plan targeting academic and professional audiences. The plan prioritized presentations and publications to maximize the research's global impact and relevance.

REFERENCES

[1] R. Kattel and I. Mergel, *Estonia's Digital Transformation*. Oxford, UK: Oxford Univ. Press, 2019, doi: 10.1093/oso/9780198843719.003.0008.

[2] B. Bogdandy, J. Tamás, and Z. Tóth, "Digital Transformation in Education During COVID-19: A Case Study," in *Proc. IEEE Conf. Cogn. Infocommun.* (CogInfoCom), 2020, doi: 10.1109/coginfocom50765.2020.9237840.

[3] P. E. Muinda, A. H. Basaza-Ejiri, G. Maiga, and K. Mayoka, "A Digitization Model in Ugandan Technical, Vocational and Education Training Institutions: An Agency Theory Perspective," *Int. J. Digit. Educ. Technol.*, vol. 4, no. 1, pp. 1–12, 2024.

[4] G. M. Kituyi, E. Abaho, D. Aguma, and I. Nkambwe, "Improving Access to Communication Services by the Unserved and Underserved Communities in Uganda Through Information Communication Technology," *Sci. Rep.*, vol. 5, no. 2, 2024, doi: 10.21203/rs.3.rs-3967027/v1.

[5] A. Nabulongo, V. S. Manjula, and F. Marega, "Impact of Digitization of Sustainable Agriculture in Uganda: A Case Study," *J. Agric. Sustain. Innov. Commun.*, vol. 4, no. 1, pp. 1–12, 2023, doi: 10.59568/jasic-2023-4-1-01.

[6] N. H. S. Bitesigirwe and F. Ndede, "Effects of Project Implementation Practices on Project Performance in Tanzania: The Case of Mnazi Bay Gas," *Int. J. Proj. Manag.*, vol. 5, no. 1, pp. 56–73, 2023, doi: 10.47672/ijpm.1638.

[7] A. Kacprzak and A. Chrzaszcz, "Communication in Multigenerational Project Teams During the COVID-19 Pandemic: The Perspective of Team Members," *Eur. Res. Stud. J.*, vol. 26, no. 1, pp. 231–248, 2023, doi: 10.35808/ersj/3197.

[8] P. Tuenpusa, "Workforce Skill Development Policy Guideline for Industrial Revolution in Thailand," *J. Educ. Soc. Behav. Sci.*, vol. 34, no. 1, pp. 78–92, 2021, doi: 10.9734/jesbs/2021/v34i1130376.

[9] T. C. Ogbuanya and T. O. Shodipe, "Workplace Learning for Pre-Service Teachers' Practice and Quality Teaching and Learning in Technical Vocational Education and Training: Key to Professional Development," *J. Workplace Learn.*, vol. 33, no. 5, pp. 415–433, 2021, doi: 10.1108/jwl-02-2021-0015.

[10] I. M. Okumu and E. Bbaale, "Technical and Vocational Education and Training in Uganda: A Critical Analysis," *Dev. Policy Rev.*, vol. 37, no. 6, pp. 735–749, 2019, doi: 10.1111/dpr.12407.

[11] S. Nakaziba and P. Ngulube, "Harnessing Digital Power for Relevance: Status of Digital Transformation in Selected University Libraries in Uganda," *Collect. Curation*, vol. 3, no. 1, pp. 101–112, 2024, doi: 10.1108/cc-11-2023-0034.

[12] P. Sampaio, A. C. A. Carvalho, P. Domingues, and P. Saraiva, "Guest Editorial: Quality in the Digital Transformation Era," *Int. J. Qual. Reliab. Manag.*, vol. 40, no. 2, pp. 123–130, 2022, doi: 10.1108/ijqrm-06-2022-415.

[13] N. Mbanga and V. Mtembu, "Digital Learning: Perceptions of Lecturers at a Technical Vocational Educational and Training College," *J. Educ. Sci. Technol.*, vol. 34, no. 4, pp. 201–216, 2020, doi: 10.20853/34-4-3656.

[14] A. E. Ismail, A. H. A. Syakir, I. A. Bahrudin, and M. S. M. Shafieek, "Implementation of Distance and Digital Learning During Pandemic COVID-19 in Malaysia," *Open J. Technol. Pedagog.*, vol. 7, no. 1, pp. 23–35, 2022, doi: 10.30880/ojtp.2022.07.01.002.

[15] J. I. Oviawe, "Bridging Skill Gap to Meet Technical, Vocational Education and Training School-Workplace Collaboration in the 21st Century," *Int. J. Vocat. Educ. Train. Res.*, vol. 3, no. 1, pp. 15–30, 2017, doi: 10.11648/j.ijvetr.20170301.12.

[16] D. Kintu, K. Kitainge, and A. Ferej, "Employers' Perceptions About the Employability of Technical, Vocational Education and Training Graduates in Uganda," *Adv. Ind. Res.*, vol. 18, no. 2, pp. 55–70, 2019, doi: 10.9734/air/2019/v18i230087.

[17] L. Caluwe, S. De Haes, C. Wilkin, and T. Huygh, "How Boards of Directors Can Contribute to Governing IT," in *Proc. 54th Hawaii Int. Conf. Syst. Sci.*, 2021, vol. 0, pp. 6047–6056, doi: 10.24251/hicss.2021.731.

[18] S. J. Nyeko, "Information Technology Governance Effectiveness in Uganda's Public Universities," *ICT Univ. J.*, vol. 1, no. 1, pp. 41–57, 2019.

[19] L. Moudoubah, A. El Yamami, K. Mansouri, and M. Qbadou, "From IT Service Management to IT Service Governance: An Ontological Approach for Integrated Use of ITIL and COBIT Frameworks," *Int. J. Electr. Comput. Eng.*, vol. 11, no. 6, pp. 5292–5300, 2021, doi: 10.11591/ijece.v11i6.pp5292-5300.

[20] A. Riyadi, Yennisa, and L. Sagita, "COSO's Conceptual Framework to Internal Control Management Risk in Higher Education Management," *Int. J. Account. Manag.*, vol. 5, no. 2, pp. 112–125, 2021.

[21] R. C. Mahaney and A. L. Lederer, "Information Systems Project Management: An Agency Theory Interpretation," *J. Syst. Softw.*, vol. 68, no. 1, pp. 1–9, 2003, doi: 10.1016/S0164-1212(02)00132-2.

[22] R. Joslin and R. Müller, "The Relationship Between Project Governance and Project Success," *Int. J. Proj. Manag.*, vol. 34, no. 4, pp. 613–626, 2016, doi: 10.1016/j.ijproman.2016.01.008.

[23] J. Samáková, D. Babčanová, H. H. Chovanová, J. Mesárošová, and J. Šujanová, "Project Communication Management in Industrial Enterprises (Step by Step)," *IntechOpen*, 2018, doi: 10.5772/intechopen.75160.

[24] M. S. Winters, "Too Many Cooks in the Kitchen? The Division of Financing in World Bank Projects and Project Performance," *Polit. Gov.*, vol. 7, no. 2, pp. 117–126, 2019, doi: 10.17645/pag.v7i2.1826.

[25] L. N. Amali, M. Mahmuddin, and M. Ahmad, "Information Technology Governance Framework in Public Sector Organizations," *Telkomnika (Telecommun. Comput. Electron. Control)*, vol. 12, no. 2, pp. 429–436, 2014, doi: 10.12928/TELKOMNIKA.v12i2.1834.

[26] F. Teixeira et al., "Digital Maturity and Its Determinants in General Practice: A Cross-Sectional Study in 20 Countries," *Front. Public Health*, vol. 10, 2023, doi: 10.3389/fpubh.2022.962924.

[27] K. Flott, R. Callahan, A. Darzi, and E. Mayer, "A Patient-Centered Framework for Evaluating Digital Maturity of Health Services: A Systematic Review," *J. Med. Internet Res.*, vol. 18, no. 4, 2016, doi: 10.2196/jmir.5047.

[28] R. A. Eisenbeis, "Agency Problems and Goal Conflicts," *SSRN Electron. J.*, 2005, doi: 10.2139/ssrn.639646.

[29] K. M. Eisenhardt, "Agency Theory: An Assessment and Review," *Acad. Manag. Rev.*, vol. 14, no. 1, pp. 57–74, 1989.

[30] A. J. Pramono, S. Suwarno, F. Amyar, and R. Friska, "Exploring Technology Acceptance in Management Accounting Tools' Adoption in Public Sector Accounting: A Sustainability Perspective for Organizations," *Sustainability*, vol. 15, no. 21, p. 15334, 2023, doi: 10.3390/su152115334.

[31] S. Chatterjee, R. Chaudhuri, D. Vrontis, and G. Basile, "Digital Transformation and Entrepreneurship Process in SMEs of India: A Moderating Role of Adoption of AI-CRM Capability and Strategic Planning," *J. Strateg. Manag.*, vol. 14, no. 4, 2021, doi: 10.1108/jsma-02-2021-0049.

[32] P. Berthon, L. Pitt, M. Ewing, and C. L. Carr, "Potential Research Space in MIS: A Framework for Envisioning and Evaluating Research Replication, Extension, and Generation," *Inf. Syst. Res.*, vol. 13, no. 4, pp. 416–427, 2002, doi: 10.1287/isre.13.4.416.71.

[33] C. C. Chen, C. C. H. Law, and S. Yang, "Managing ERP Implementation Failure: A Project Management Perspective," *IEEE Trans. Eng. Manag.*, vol. 56, no. 2, pp. 210–220, 2009, doi: 10.1109/tem.2008.2009802.

[34] M. Fraser-Arnott, "Combining Project Management and Change Management for Project Success in Libraries," in *Project Management in the Library Workplace*, vol. 38, Emerald Publishing Limited, 2018, pp. 167–186.

[35] E. Salas, J. L. Wildman, and R. F. Piccolo, "Using Simulation-Based Training to Enhance Management Education," *Acad. Manag. Learn. Educ.*, vol. 8, no. 4, pp. 559–573, 2009, doi: 10.5465/amle.8.4.zqr559.

[36] F. Fischer, O. Chernikova, and A. Opitz, "Learning to Diagnose With Simulations: Introduction," *Springer, Cham.*, 2022, doi: 10.1007/978-3-030-89147-3_1.

[37] C. Jenerette, C. L. Murillo, A. Chew, and D. J. Barksdale, "Simulation in PhD Programs to Prepare Nurse Scientists as Social Justice Advocates," *Nurse Educ. Perspect.*, 2021, doi: 10.1097/01.nep.0000000000000835.

[38] M. M. Al-Ababneh, "Linking Ontology, Epistemology, and Research Methodology," *Sci. Philos.*, vol. 8, no. 1, pp. 75–91, 2020, doi: 10.23756/sp.v8i1.500.

[39] N. Shrestha, "Factor Analysis as a Tool for Survey Analysis," *Am. J. Appl. Math. Stat.*, vol. 9, no. 1, pp. 4–11, Jan. 2021, doi: 10.12691/ajams-9-1-2.

[40] V. Braun, V. Clarke, and N. Hayfield, "Thematic Analysis: A Reflexive Approach," *SAGE Publications*, 2023.

[41] S. Sismanto, Y. Cikusin, and J. Mistar, "Challenges and Strategies in Adopting Google Workspace for Education: Perspectives From Educational Leaders in Indonesia," *Asian J. Educ. Soc. Sci.*, vol. 50, no. 4, pp. 1328–1342, 2024, doi: 10.9734/ajess/2024/v50i41328.

[42] N. Mirza, N. Akhtar–Danesh, C. Noesgaard, L. Martin, and E. Staples, "A Concept Analysis of Abductive Reasoning," *J. Adv. Nurs.*, vol. 70, no. 3, pp. 623–634, 2014, doi: 10.1111/jan.12379.

[43] J. Wheeldon, "Mapping Mixed Methods Research: Methods, Measures, and Meaning," *J. Mix. Methods Res.*, vol. 4, no. 2, pp. 87–102, Apr. 2010, doi: 10.1177/1558689809358755.

[44] W. H. DeLone and E. R. McLean, "Information Systems Success: The Quest for the Dependent Variable," *Inf. Syst. Res.*, vol. 3, no. 1, pp. 60–95, 1992.

[45] T. Gerlach, U. Durak, and J. Gotschlich, "Model Integration Workflow for Keeping Models Up to Date in a Research Simulator," in *Proc. Int. Conf. Model. Simul. Technol.*, 2014, pp. 125–132, doi: 10.5220/0005011301250132.

[46] D. J. Teece, G. Pisano, and A. Shuen, "Dynamic Capabilities and Strategic Management," *Strateg. Manag. J.*, vol. 18, no. 7, pp. 509–533, 1997, doi: 10.1002/(SICI)1097-0266(199708)18:7<509::AID-SMJ882>3.0.CO;2-Z.

[47] A. Bans-Akutey and B. M. Tiimub, "Triangulation in Research," *Acad. Lett.*, no. August, pp. 1–6, 2021, doi: 10.20935/al3392.

[48] ISO/IEC, "9126 Software Product Evaluation–Quality Characteristics and Guidelines for Their Use," *ISO/IEC Stand.*, vol. 9126, 2001.

[49] S. De Haes, W. Van Grembergen, A. Joshi, and T. Huygh, "Enterprise Governance of IT, Alignment, and Value," in *Proc. Int. Conf. IT Governance & Alignment*, 2020, pp. 1–13, doi: 10.1007/978-3-030-25918-1_1.

[50] M. Noordzij, G. Tripepi, F. W. Dekker, C. Zoccali, M. W. Tanck, and K. J. Jager, "Sample Size Calculations: Basic Principles and Common Pitfalls," *Nephrol. Dial. Transplant.*, vol. 25, no. 5, pp. 1388–1393, 2010, doi: 10.1093/ndt/gfp732.

[51] M. Saunders, P. Lewis, and A. Thornhill, *Research Methods for Business Students*, 8th ed. Pearson, 2019.

[52] R. Schuster, T. Kaiser, Y. Terhorst, E.-M. Meßner, L.-M. Strohmeier, and A. Laireiter, "Sample Size, Sample Size Planning, and the Impact of Study Context: Systematic Review and Recommendations by the Example of Psychological Depression Treatment," *Psychol. Med.*, vol. 51, no. 12, pp. 2065–2082, 2021, doi: 10.1017/s003329172100129x.

[53] J. W. Creswell and J. D. Creswell, *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*, 5th ed. Thousand Oaks, CA: Sage Publications, 2017.

[54] R. C. Mahaney and A. L. Lederer, "Information Systems Project Management: An Agency Theory Interpretation," *J. Syst. Softw.*, vol. 68, no. 1, pp. 1–9, 2003, doi: 10.1016/S0164-1212(02)00132-2.

[55] Z. Yu and Y. Xiaozhi, "An Extended Technology Acceptance Model of a Mobile Learning Technology," *Comput. Appl. Eng. Educ.*, vol. 27, no. 4, pp. 842–855, 2019, doi: 10.1002/cae.22111.

[56] E. Vaportzis, M. G. Clausen, and A. J. Gow, "Older Adults' Perceptions of Technology and Barriers to Interacting With Tablet Computers: A Focus Group Study," *Front. Psychol.*, vol. 8, 2017, doi: 10.3389/fpsyg.2017.01687.

[57] S. K. Y. Chow, W. Chin, H.-Y. Lee, H. Leung, and F. Tang, "Nurses' Perceptions and Attitudes Towards Computerisation in a Private Hospital," *J. Clin. Nurs.*, vol. 20, no. 5–6, pp. 812–821, 2011, doi: 10.1111/j.1365-2702.2011.03905.x.

[58] V. Venkatesh, "Determinants of Perceived Ease of Use: Integrating Control, Intrinsic Motivation, and Emotion Into the Technology Acceptance Model," *Inf. Syst. Res.*, vol. 11, no. 4, pp. 342–365, 2000, doi: 10.1287/isre.11.4.342.11872.

[59] T. Lappi, "Digitalizing Finland: Governance of Government ICT Projects," *Univ. Oulu Grad. Sch.*, 2019.

[60] M. S. Castro, P. M. Klajnberg, and A. Barcauí, "The Impact of Stakeholder Salience in the Relationship Between Stakeholder-Oriented Governance Practices and Project Success," *IntechOpen*, 2024, doi: 10.5772/intechopen.1004895.

[61] S. Gregor and D. Jones, "The Anatomy of a Design Theory," *J. Assoc. Inf. Syst.*, vol. 8, no. 5, pp. 312–335, 2007, doi: 10.17705/1jais.00129.

[62] A. Benlian and I. Haffke, "Does Mutuality Matter? Examining the Bilateral Nature and Effects of CEO–CIO Mutual Understanding," *J. Strateg. Inf. Syst.*, vol. 25, no. 2, pp. 104–126, 2016.

[63] A. M. Johnson and A. L. Lederer, "The Impact of Communication Between CEOs and CIOs on Their Shared Views of the Current and Future Role of IT," *Inf. Syst. Manag.*, vol. 24, no. 1, pp. 85–90, 2006, doi: 10.1080/10580530601038246.

[64] R. Basu, "Managing Quality in Projects: An Empirical Study," *Int. J. Proj. Manag.*, vol. 32, no. 5, pp. 761–773, 2014, doi: 10.1016/j.ijproman.2013.02.003.

[65] M. D. Myers and J. R. Venable, "A Set of Ethical Principles for Design Science Research in Information Systems," *Inf. Manag.*, vol. 51, no. 6, pp. 801–809, 2014, doi: 10.1016/j.im.2014.01.002.