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Developing digital capabilities through IT governance: a PLS-SEM analysis in Moroccan higher education institutions

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ABSTRACT

This study examines the impact of information technology governance (ITG) on digital transformation (DT) in Moroccan higher education institutions, particularly emphasising the mediating role of absorptive capacity. Utilising a rigorous methodological framework, the research analyzes data collected from 110 staff members using structural equation modelling with the SmartPLS tool. The goal is to explore the complex dynamics between ITG practices and DT capability. The findings reveal a positive and statistically significant relationship between ITG mechanisms and absorptive capacity (AC) and between the latter and the success of DT. The study also identifies AC as a crucial mediator between ITG and digital capability (DC). It suggests universities should strengthen their AC and adopt open policies to increase their innovative potential. This contribution enriches the existing literature by empirically confirming the influence of certain IT governance variables on DC within Moroccan universities, offering valuable insights for academic researchers and practitioners involved in IT governance strategies and DT.

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1. INTRODUCTION

To maintain and improve organizational performance and efficiency, it is crucial to align with the continuous advancements in information technology [1]. This requires universities to frequently update their information technology governance (ITG) to meet innovation demands and adjust to new technologies. Many researchers emphasize the importance of effectively leveraging ITG tools within higher education institutions [2]–[6], particularly regarding structure, processes, and relational mechanisms [7]–[9]. According to Osmundsen *et al.* [10], studying the role of IT governance in relation to digital transformation (DT) can provide valuable insights for information systems specialists and practitioners.

According to [11]–[14], various obstacles hinder DT, necessitating the adoption of effective governance mechanisms. Although numerous studies have explored the correlation between the effectiveness of IT governance and DT, the findings are often uncertain. As indicated by [15], it is essential to better understand the actual impact of IT governance on the success of DT. In other words, it is about defining more clearly how IT governance influences the success of this transformation. This study aims to address this gap by analyzing this relationship through the lens of organizational learning (OL).

This article seeks to develop an evaluation model for DT, applying the ACapproach, a fundamental aspect of organizational OL. This model is particularly suited to the higher education sector, as existing

reviews suggest that most DT models are designed primarily for private organizations, with little attention paid to the academic field. Focusing on ACas a central vector of OL, this study employs partial least squares structural equation modeling (PLS-SEM) to rigorously analyze empirical data collected from 110 academic and administrative staff members from various Moroccan higher education institutions. The research aims to decipher the sophisticated interactions between ITG variables and ACto assess their direct and mediated influence on the success of DT. Statistical analyses reveal a significant and positive link between IT governance practices and the enhancement of absorptive capacity (AC), thus favorably impacting the digitalization process. These findings highlight the importance of robust IT governance as a catalyst for the effective absorption and integration of digital innovations into institutional practices. This contribution deepens the understanding of the structural mechanisms that facilitate DT in the higher education context, providing critical strategic insights for researchers and practitioners focused on governance and optimization of information technologies.

2. LITERATURE REVIEW

2.1. The importance of information technology governance in digital transformation success

Numerous studies in the private sector have highlighted the crucial role of ITG in the success of DT. According to Afifah *at el.* [16], it has been established that IT governance mechanisms (ITGM) significantly contribute to the effectiveness of DT. Furthermore, another study [17] found that governance committees substantially strengthen corporate governance in organizations engaged in DT. However, research focusing on these aspects in the academic environment remains limited. Additionally, a survey [18] examined the ITG strategies universities could implement to overcome the challenges of various DT contexts, both IT management and academics. The effectiveness of IT governance is vital as it allows digitally-focused organizations to capitalize on emerging business opportunities [19]. A case study at a large public university in Kazakhstan examined the impact of IT governance across eleven dimensions, thus fostering DT within the academic environment [20].

2.2. Organizational learning theory

Academic literature emphasizes the importance of OL as a crucial strategic instrument for reaching goals and navigating change [21], [22]. This process, vital for creating new knowledge and securing a competitive edge, involves the efficient use of external information, particularly through open innovation [22]. It involves enhancing existing knowledge and creating new knowledge, focusing on evolving perspectives and forming links between past and future actions. Individuals within the organization play a crucial role in identifying and acquiring the necessary information to explore new opportunities and leverage existing knowledge.

Research conducted in Indonesia reveals that OL improves skill development, learning capacity, innovation, and the effectiveness of programs within an Islamic university setting [23]. Employee engagement in decisions also strengthens OL and the overall performance of the university [24]. Moreover, learning capacity and organizational creativity are essential for fostering innovation within educational institutions [25].

2.3. Absorptive capacity

AC, defined as an organization's ability to identify, assimilate, transform, and apply knowledge, is crucial for the success of DT. This capacity, a pillar of OL, relies on effectively using existing knowledge to integrate and transform new knowledge to create value [26]. ersonal learning processes contribute to the improvement of managerial abilities, whereas organizational processes strengthen overall organizational capabilities [27].

As noted by [28], management should prioritize four essential dimensions to improve AC within IT governance: existing knowledge, a robust communication network, a supportive communication environment, and proactive knowledge exploration. The role of governance and knowledge sharing in enhancing AC is highlighted, as it can substantially boost project outcomes [29]. Though less frequently studied in academic contexts, research [30] integrates this concept into a model for IT governance performance in higher education, showing that proper structures and processes facilitate productive collaboration between IT and academic departments [31].

This work illustrates the impact of ACon DT, highlighting the essential alignment between IT departments and the entire organization. This alignment positively influences strategic vision (SV), objectives, technological resources, know-how, digital competence, and innovation culture (CI), thus creating an environment conducive to the success of DT and the organization's adaptation to the digital era.

3. OPERATIONALIZATION OF VARIABLES AND HYPOTHESIS DEVELOPMENT

This section will discuss each variable in the research model, followed by the justification for hypothesis development.

3.1. IT governance mechanisms and absorptive capacity

In higher education institutions, ITG is structured around three core capabilities: structural, process, and relational.

a. Structural capabilities: are defined by clear roles and responsibilities [32], the creation of IT strategy committees [33]–[36] and IT steering committees [37]–[39], appropriate organizational structures [40], [41], and the involvement of the CIO in executive decision-making [42]. These components are vital for fostering effective IT governance and improving the AC of IT systems in these institutions.
b. Process capabilities: involve activities such as strategic planning for information systems [43], [44], project portfolio management [45]–[47], and the adoption of IT governance frameworks like COBIT, ITIL, ISO, PRINCE2, PMBOK, and BSC [48]–[52]. These processes are essential for setting priorities and enhancing the operational efficiency of IT governance.
c. Relational capabilities: include IT leadership [53], formal communication mechanisms [43], [45], [49], and knowledge management practices [43], [49], [54]. These elements support strategic communication, shared learning, and collaboration between IT and business functions, ultimately improving IT governance outcomes.

The integration of these structural, process, and relational capabilities forms the basis for Hypothesis H1, which emphasizes the need for a comprehensive approach to enhance IT governance effectiveness in higher education institutions.

H1: the IT governance mechanism positively influences the AC of IT governance in higher education institutions.

3.2. Absorptive capacity and digital transformation

AC plays a critical role as a moderating factor in various areas of innovation and technology, as confirmed by numerous studies. For instance, one study [55] found that high levels of prior knowledge and AC amplify the effect of advanced technological expertise on value creation. Another study [56] demonstrated that AC moderates the link between external knowledge inflows and innovation performance. Moreover, AC is vital for converting information into actionable insights that drive innovation [57]. In the academic sphere, AC has been utilized to assess how IT competencies influence the quality of MOOCs produced by universities [58], as well as to explore its mediating role between knowledge sharing and innovation capacity, with findings indicating a positive relationship between innovation capacity and competitive advantage [59]. This brings us to the following hypothesis:

H2: absorptive capacity positively moderates the relationship between IT governance mechanisms and innovation capacity in higher education institutions.

3.3. Absorptive capacity as a mediator

Higher education institutions must adopt effective DT strategies and optimize their IT resources to achieve their goals. ITGM offer the necessary organizational frameworks that allow IT managers and institutional leaders to collaborate, share expertise, and exchange knowledge. For example, IT managers can support academic leaders by helping them identify appropriate IT solutions for their departments, often by delegating decision-making to the IT unit.

AC of IT governance plays a crucial role in this collaboration, as it facilitates the understanding, integration, and effective use of IT knowledge and innovations. Thus, we propose that AC positively impacts the relationship between ITGM and the success of DT in higher education institutions. This leads to the following hypothesis:

H3: the AC plays a mediator role in the positive impact of governance mechanisms on DT in higher education institutions.

3.4. IT governance mechanisms and digital transformation

Research in both private and public sectors has assessed the impact of ITG on DT. A study [60] demonstrated that hybrid ITGM facilitate the success of DT and the achievement of operational objectives, particularly in public sector ministries. Mulyana *et al.* [61] discovered that these hybrid mechanisms moderately influence DT, which in turn significantly enhances organizational performance. In the academic context, a study [62] developed a conceptual framework to advance academic programs through web systems, while another research [50] applied the COBIT 2019 framework to assess the maturity of IT processes in a small higher education institution, illustrating the importance of these frameworks in the effectiveness of DT. These studies converge on the hypothesis that ITG is essential for effectively supporting DT.

H4: the capacity of IT Governance mechanism positively influences the success of DT in higher education institutions.

3.5. Success of digital transformation within HEIs

For effective DT, it is crucial to establish key elements such as SV, strategic alignment (AS), technological assets (AT), know-how and intellectual property (KIP), digital capability (DC), and CI. SV requires motivating employees towards digital maturity and developing a detailed technological model with a precise action plan [63], [64]. AS involves prioritizing technological investments with a clear roadmap [63]. AT require the execution of pilot projects to test the proposed changes [63], [64].

Furthermore, developing KIP includes training educators on the benefits of technology and encouraging them to adopt innovation [63]–[65]. DC focuses on enhancing the digital skills of teaching staff [63]–[66], and CI promotes the development of a culture conducive to digital teaching and experimentation [64], [67].

The study highlights the importance of an integrated approach. These six key factors, when well-established, can significantly influence the success of DT, particularly in the education sector [68]. Our research significantly contributes to validating hypotheses focused solely on the success factor of DC. Our findings suggest that AC and IT governance play a crucial role in the success of this factor.

- SV: a digital SV for the future exists.
- AS: the commitment and collaboration to support DT from the strategic to the operational level.
- AT: ownership of digital technologies.
- Know-how and KIP: mastery of using digital platforms as a lever.
- DC: the availability of digital talents.
- CI: mechanisms that encourage invention and risk-taking.

Previous studies have examined and validated the link between IT governance and organizational performance [30], [69]. Yet, none have explored the impact of ITGM on the success of DT from the perspective of AC within the academic context. Figure 1 proposed a conceptual model to better understand the impact of IT governance and AC on the digitalization of higher education institutions by addressing only the digital capacity dimension.

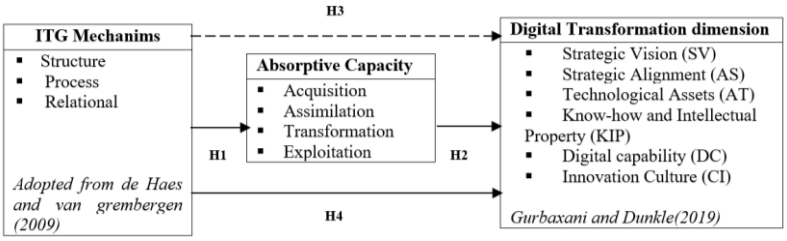

Figure 1. Conceptual model of ITGM impact on DT through AC

4. METHOD

Data were gathered from five renowned educational institutions in Morocco, all of which had successfully implemented ITGM. The primary goal was to collect a sufficient sample, and the online survey generated responses from 110 participants. After discarding five incomplete questionnaires, 105 valid responses remained, yielding a 95% response rate. These 105 responses were considered the final sample size, following the recommendations of [70].

The study employed 40 items designed to assess the characteristics of ITGM, AC, and DC, with the items adapted from previous studies [71]–[73]. An interval scale was used to capture the degree of agreement or disagreement with the statements, ranging from 1 (strongly disagree) to 5 (strongly agree). The data were then analyzed using SmartPLS to identify key predictors of DT success. The respondents included 25% teaching staff (n=24) and 34% business managers (n=33), with the majority consisting of CIOs and IT managers. SmartPLS was chosen for its ability to model causal relationships and test hypotheses based on respondent data. The software includes measurement and structural models for validating constructs. To assess validity and reliability, the measurement model examines composite reliability (CR), average variance extracted (AVE), and discriminant validity. High reliability and the absence of discriminant validity issues are confirmed when the CR exceeds 0.5. Discriminant validity is assessed following the approach of [74], where the square root of AVE for each construct must be greater than its correlations with other constructs.

5. RESULTS AND DISCUSSION

Table 1 shows the convergent validity values consisting of factor loadings, CR (CR=0.901, AVE=0.645 for ITG mechanism), (CR=0.887, AVE=0.611 for DC), and AC (CR=0.976, AVE=0.870 for AC). The results indicate that each item and construct in the model meets the threshold CR values above 0.7, with AVE greater than 0.5. The factorial saturation of the tested items was greater than 0.5 and could be used in the analysis. In terms of the measurement model, Table 2 describes the analysis results and establishes that the Discriminant validity is achieved. It can, therefore, be concluded that the main concept measures different aspects.

Table 1. Convergent validity

Variables	Item code	Factor loading	CA	CR	AVE
ITGM			0.861	0.901	0.645
Structural mechanism (SM)	MS1	0.729			
	MS2	0.718			
	MS3	0.881			
Process mechanism (PM)	MP1	0.797			
	MP2	0.772			
	MP3	0.780			
	MP4	0.752			
Relational mechanism (RM)	MR1	0.792			
	MR2	0.785			
	MR3	0.735			
DC			0.840	0.887	0.611
	CD1	0.868			
	CD2	0.879			
	CD3	0.907			
	CD4	0.886			
	CD5	0.869			
	CD6	0.881			
	CD7	0.894			
	CD8	0.889			
	CD9	0.902			
AC			0.970	0.976	0.870
Acquisition	Asq1	0.777			
	Asq2	0.802			
	Asq3	0.759			
	Asq4	0.760			
	Asq5	0.775			
Assimilation	Ass1	0.721			
	Ass2	0.817			
	Ass3	0.749			
	Ass4	0.729			
	Ass5	0.801			
Transformation	Tran1	0.813			
	Tran2	0.803			
	Tran3	0.741			
	Tran4	0.797			
	Tran5	0.747			
Exploitation	Exp1	0.862			
	Exp2	0.786			
	Exp3	0.777			
	Exp4	0.743			
	Exp5	0.871			
	Exp6	0.773			

Table 2. Discriminant validity test (Fornell–Larcker)

	AC	Asq	Ass	DC	Exp	MITG	MP	MR	MS	Tran
AC	0.932									
Asq	0.931	0.976								
Ass	0.959	0.940	0.979							
DC	0.199	0.174	0.172	0.781						
Exp	0.808	0.723	0.785	0.213	0.785					
MITG	0.093	0.053	0.059	0.419	0.129	0.803				
MP	0.164	0.105	0.120	0.410	0.206	0.701	0.709			
MR	0.110	0.094	0.093	0.314	0.104	0.775	0.688	0.783		
MS	0.045	0.075	0.075	0.376	0.013	0.859	0.659	0.628	0.880	
Tran	0.910	0.865	0.904	0.186	0.888	0.104	0.179	0.121	0.044	0.961

6. STRUCTURAL MODEL

Figure 2 presents the measurement model, illustrating that ITGM has a positive impact on AC, which in turn positively influences DC. The PLS-SEM results showed that H1: ITGM had a direct, positive, and significant impact on AC with (β=0.103, t=2.370, p<0.018). For H2: AC had a direct, positive, and significant impact on DC with (β=0.162, t=4.338, p<0.000). Also, H3: ITGM had a direct, positive, and significant impact on CD with (β=0.444, t=9.974, p<0.000). H4: AC had a positive and significant mediating effect between the relationship of MITG and CD with (β=0.017, t=2.158, p<0.000).

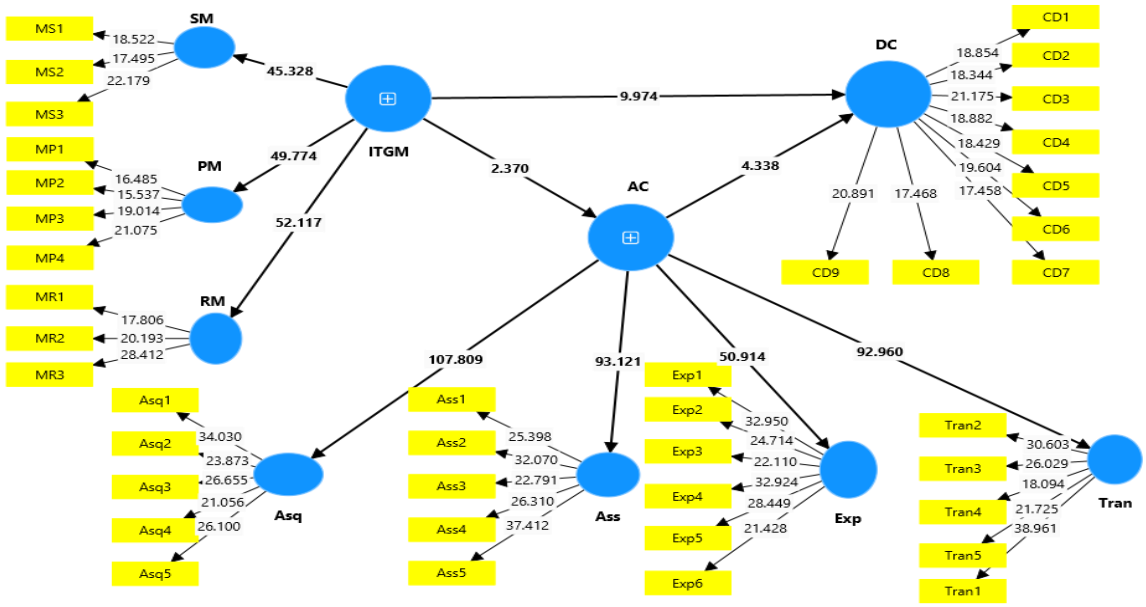

Figure 2. Structural model of IT governance, AC, and DC in higher education

Table 3 presents the interaction of openness on the relationship between ITGM and DC. In terms of analysis, it can be said that although AC plays a mediating role in the relationship between ITGM and DC (as shown by H4), its mediating effect is weaker than the direct effect of ITGM on DC (H3). This may suggest that while AC has a positive effect, it does not capture all the variance in the relationship between ITGM and DC. In other words, ITGM has a more direct and perhaps more relevant impact on DC than AC. This does not mean that the mediating role of AC is negligible or limited in absolute terms; it is simply less strong than the direct effect in this case.

Table 3. Relationship between variables

Effect	Hypothesis	Relationships	Beta	Mean	(STDEV)	t-value	p-value	Decision
Direct	H1	ITGM→AC	0.103	0.102	0.043	2.370	0.018	Supported
	H2	AC→DC	0.161	0.162	0.037	4.338	0.000	Supported
	H4	ITGM→DC	0.444	0.445	0.045	9.974	0.000	Supported
Indirect	H3	ITGM→AC→DC	0.017	0.016	0.008	2.158	0.000	Supported

7. THEORETICAL IMPLICATIONS

This study enriches the theoretical understanding of Management ITGM in Higher Education Institutions (HEIs), building on a conceptual model that has so far primarily explored AC in a limited way [30]. Our research not only validates this model by quantifying the direct and indirect impacts on DC, but it also reveals that the direct effect between ITGM and DC is more significant than the effect mediated by AC, thus corroborating the findings of other studies [72], [75], [76]. Our findings indicate that managing the mediating effect of AC must be approached with caution due to its high costs and the length of the processes involved. Nevertheless, previous research has highlighted a mediating effect of this capacity that is more significant than its direct effect [77], underscoring the importance of maturity through the stages of acquisition, assimilation, transformation, and exploitation to substantially impact DT. Our results thus contribute to the literature on open innovation and bridge the gap between ITGM and DC.

8. LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

This study has highlighted certain limitations, including the use of cross-sectional data and time constraints during data collection, suggesting the need for more comprehensive approaches in the future. Future research could extend over a longer period and include a larger sample to enhance the generalizability of the results. A cross-sectoral analysis could also provide a richer perspective on the concepts studied. By focusing on a single DC variable, this research paves the way for incorporating other variables in future studies to assess their collective impact on DT. It is also recommended to expand the geographical scope of the research by including higher education institutions from other regions or countries to identify potential cultural or regional differences in the application of ITGM and their impact on DT. Finally, it would be relevant to explore new approaches or IT governance frameworks emerging with recent technological advancements, such as artificial intelligence or blockchain, to assess their potential to strengthen DT in various contexts.

9. CONCLUSION

This study crucially highlights the positive and substantial role that ITG mechanisms play in enhancing DT within Moroccan higher education institutions. By rigorously using structural equation modeling, the research not only confirms the critical mediating role of AC in facilitating the successful integration of digital capabilities, but also provides empirical evidence on the effectiveness of practices specific to ITG. The findings argue for increased focus on developing AC and adopting open policies to support innovation, providing a strategic blueprint for universities aiming to thrive in the digital age. This contribution enriches existing literature and presents actionable insights for academic researchers and IT governance practitioners, highlighting the complex dynamics between ITG practices and DT capabilities. As the digital landscape evolves, this study highlights the importance of continuous learning and adaptation, reinforcing the need for institutions to remain agile and responsive to technological advances.

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