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Synergy between Digitalization and Performance of Moroccan Public Universities: The Mediating Role of Technological Innovation

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ABSTRACT

In Morocco, digitalization has become a strategic priority in socio-economic development policies, with public authorities implementing structural strategies to support digital transformation in public institutions. Beyond the mere dematerialization of processes, digitalization challenges traditional organizational models and compels public institutions to rethink governance and operational practices. By adopting a quantitative approach, this study investigates the role of technological innovation in mediating the relationships between digitalization and the performance of public services in Moroccan public universities. Using the partial least squares structural equation modelling (PLS-SEM), the findings reveal that the adoption of digitalization has a low direct effect on university performance ($\beta = 0.043$, $P \leq 0.050$). Moreover, technological innovation exerts a significant mediating effect ($\beta = 0.16$, $P = 0.021$), affirming its central role in improving the impact of digitalization on the performance of Moroccan public universities.

Keywords: Digital Transformation, Public Performance, Moroccan Universities, PLS-SEM
JEL Classifications: I23, O32, C38

1. INTRODUCTION

In a complex and constantly changing environment, technological advances are transforming the daily lives of citizens and organizations. In this context, the public debate surrounding technological transition has evolved considerably, and Morocco is no exception. Public decision-makers have committed to implementing structural projects to support the country's transition to the digitalization of public services, notably E-Morocco 2010, Digital Morocco 2013, Digital Morocco 2030, etc.

Furthermore, with a view to responding quickly to citizens' needs, Morocco has made the digitalization of public services a national priority, which was formalized in 2017 with the creation of the digital development agency, whose mission is to develop the digital economy. For their part, public universities have committed to implementing a series of measures aimed at digitizing the services they provide to users. Analysis of numerous research studies illustrates that universities are playing a decisive role in training and qualifying human resources. Furthermore, universities are stepping up their promotion of research and development (R&D), particularly in areas closely linked to industry as noted by Gagnol and Héraud (2001). These universities are playing a crucial role in creating growth and consolidating countries' economic competitiveness.

Other scientific papers have been written on this topic, notably those by Metcalfe and Ramlogan (2008). The two authors argue that countries that have the capacity to translate knowledge into production skills are countries that will successfully complete

the various stages of their economic development. Other authors, such as Lucas (1988) and El Hajjam (2023), have examined the relationship between human resource skills and economic development. These researchers have highlighted the crucial role of human capital, demonstrating that it has a positive and significant influence on economic growth.

Digitalization is of particular interest to decision-makers, researchers, and practitioners, who are paying increasing attention to its impact on the performance of public services, both at the national and regional levels. In their study, Mithas et al. (2012) seek to identify the nature of the relationship between innovation technological investment and profitability. The study concludes that there is a positive link between the adoption of technology and increased revenue. Theoretically, there are a number of publications that have examined the impact of digitalization on the performance of public organizations. In this regard, a study conducted by Benjouid et al. (2024) considers that engagement in digital transformation can be a driving force for regional development. In their study of a Moroccan urban municipality, Benjouid et al. (2024) point out that the use of digital solutions is a mechanism for enhancing the attractiveness of regions.

Scientific contributions, such as Ouajdouni et al. (2020), emphasize that information technologies represent a strategic opportunity, enabling users to stay up to date in the performance of tasks and facilitating the dissemination of information among all stakeholders. In one of his scientific papers, Musselin (2001), on his part, reveals that higher education institutions are constantly changing in order to adapt to the digital transformation movement. In this context, Moroccan public universities have also undergone significant changes brought about by the digital transformation of their organizational and managerial processes by implementing the development of digital technology in their strategies. This context has pushed universities to set up and develop innovative projects aimed at adapting to this sudden change and meeting the needs of public service users, while contributing to regional development. In their scientific contributions, Du Plessis (2007) and Scaringella and Radziwon (2018) support the impact of universities on regional development, thanks to their ability to contribute to the creation and strengthening of a "university ecosystem." In the same vein, Arvanitis et al. (2008) confirm the crucial role of universities as key players in the transfer of knowledge and technology, thereby strengthening the entrepreneurial sector, which is considered an essential driver of the knowledge economy.

From this perspective, evaluating the performance of public universities is a topical issue that is difficult to pin down due to the specific characteristics inherent in the activities of these organizations. In line with the New Public Management approach, this study analyzes the impact of digitalization on the performance of services offered by Moroccan public universities. In this regard, this work poses the following central question: To what extent does digitalization contribute to improving the performance of Moroccan public universities considered as actors of territorial development?

In order to answer this question, the structure of this work is based on three independent and complementary axes, combining theoretical and empirical work that provides a necessary overview of the subject. The first two axes review the state of the art, based on an analysis of several previous works in the literature, with a view to providing conceptual insights into the fundamental concepts surrounding this research. Thus, they aim to harmoniously synthesize the various relevant theories that have addressed the interaction between the variables of the subject under study. The other is an empirical investigation, conducted with the aim of getting closer to the reality on the ground by verifying the hypotheses previously put forward through discussion of the results and suggestions for future research.

2. THEORETICAL BACKGROUND

The main objective of this section is to clarify the concepts that considered as benchmarks for this research and to clearly define the terms used in this study.

2.1. Conceptual Clarification

The conceptual framing of the notions of digitalization and performance has always been a central concern for researchers. It remains an essential element in clearly situating this study/wok in its theoretical and empirical context.

2.2. Digitalization: Attempt at a Definition

Given the complexity of the field of investigation in which this work is situated, it is necessary to begin with the defining elements of the concepts on which this research is based. As such, the definition of digitalization varies among authors, which makes its conceptualization a more complex task.

According to the Organisation for Economic Co-operation and Development (2019), digitalization can be defined as a process that integrates the use of technology, digital data, and interconnections with the aim of creating new activities while improving the existing ones. Furthermore, it remains, according to Janowski (2015) and Busch and Eikebrokk (2019), a kind of transformation of administrative processes towards digitalization, helping to facilitate interaction with users by improving the quality of services provided.

In their work, Mergel et al. (2019) reveal that the digitalization of public services is a process based on the use of digital technologies, aimed at improving the efficiency, accessibility, and transparency of the services offered to users by government institutions. Other authors, such as Stolterman and Fors (2004), view digitalization as a cross-cutting concept that is difficult to define, specifying that it is a profound change brought about by the use of information technologies in all areas of activity.

2.3. Public Performance

Traditionally, performance is a term based on the combination of three fundamental criteria: Effectiveness, relevance, and efficiency (Kaplan and Norton, 1996). However, the conceptual framework of this notion remains naturally complex. In existing literature, the concept of performance is mainly used in the context of private companies, where the objective is to maximize profit.

The definition of the concept of performance differs from one author to another. Bourguignon (1995), defines performance

as a polysemic concept, characterized by the absence of a common definition among researchers. Additionally, the issue of performance has been debated in research, notably by Marion et al., who consider it to be the result of public action. According to Bourguignon (1995), performance is defined as the success of public action. However, a number of previous studies suggest that most research focuses on measuring performance rather than its actual management. In economics, performance measurement aims to attribute a result or an impact to an actor or to an organization, with a view to making an objective value judgment on the public action taken. Performance in the public sector remains complex and difficult to define. It is constantly and progressively evolving, taking different angles from one dimension of analysis to another as Stefanescu et al. (2007).

For other researchers such as Taouab and Issor (2019), performance refers to the measurement of a company's ability to achieve its goals and objectives while seeking to position itself in relation to its main competitors. Ittner and Larcker (1998) defines performance as a multidimensional construct, the evaluation of which must go beyond the financial aspect based on accounting indicators. Other researchers, such as Morin et al. (1996), have also questioned the conceptualization of the term performance. These authors argue that performance evaluation is based on four important dimensions:

- Economic efficiency;
- Human resource development;
- The sustainability of the organization;
- The legitimacy of the organization among external stakeholders.

Most literature emphasizes that performance is a mechanism recently adopted by public non-profit organizations. The introduction of the concept of performance into university management is equally a complex, multidimensional process that is difficult to analyze. For Marginson (2007), in the world of universities, performance depends on the specific nature of the services provided by these organizations, which stem from their missions: Teaching, research, and contributing to the socioeconomic development of their regions.

Following the same line of reasoning, Ory (2015) points out that the evaluation of public university performance must take into account academic indicators such as scientific reputation and scientific output. The author adds that organizational indicators must also be included, including financial and administrative management, governance, and human resources involvement.

2.4. Theoretical Framework of the Research

Technological progress has long been disrupting the traditional functioning of public institutions. In this context, managers are forced to adapt by implementing measures to strengthen digitalization in order to benefit from its contributions while reducing the associated risks.

In this sense, this research aims to analyze the relationship between the adoption of digitalization in public services and their performance in relation to users. Before formulating an empirical research question, it is relevant to present the theoretical basis of previous relevant work on which this research is based. Accordingly, this study aims to understand how previous research has addressed the issue under investigation. To this end, a set of approaches has been used to structure the theoretical framework of this study, revealing the potential links between the variables selected in the model of research.

Theoretically, other studies also support the positive relationship between the adoption of digitalization and improved public service performance. In this regard, Scott et al. (2017) and Bharadwaj (2000) and Chae et al. (2014) argues in one of their papers on the relationship between these two variables that the adoption of technology has a positive influence on improving the performance of companies engaged in financial activities, particularly in the long term.

According to a review of both theoretical and empirical literature, previous research has confirmed the positive influence of digitalization on the performance of services provided by public institutions. Based on these findings, three research hypotheses can be proposed, postulating that:

- H_1: The adoption of digitalization has a significant positive direct impact on the performance of Moroccan public universities;
- H_2: The adoption of digitalization is positively linked to technological innovation in Moroccan public universities;
- H_3: The relationship between the adoption of digitalization and the performance of Moroccan public universities is mediated by the strengthening of technological innovation.

The conceptual research model can, therefore, be summarized as follows (Figure 1):

3. RESEARCH METHOD

Providing a robust response to a problem requires researchers to determine the nature of plausible links between the constructs that make up the conceptual model of their research. Using hypothetical-deductive reasoning, this crucial step is based on an analysis of previous work, which leads us to identify the variables to be used in constructing the research model. According to Creswell (2014), in order to accelerate the research process, the quantitative approach is considered adequate. With this approach, the purpose is to identify the relationship between the adoption of digitalization and the performance of services offered by Moroccan public universities.

3.1. Operationalization of the Dependent Variable

In the field of economics and management, performance is a multidimensional construct incorporating several facets

Figure 1: The research model of the study

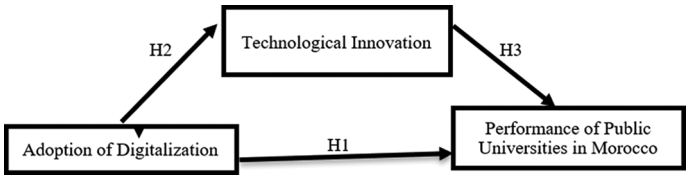


Table 1: Theories used

Theoretical approaches	Key findings	Authors
Resource-based view theory (RBV)	The performance of public companies is the result of investment and strengthening of internal resources (information technology, etc.) to gain a competitive advantage in terms of efficiency and quality	Barney (1991)
Institutional theory	Public companies must introduce and adopt digitalization in their processes in order to contribute to the dissemination of new practices	DiMaggio and Powell (1983)
Organizational process theory	Business processes must be digitized in order to improve performance through processing channels, reducing errors and improving traceability	Fayol (1916)
Decision-making theory (Cyert and March)	The need to use information and communication technologies in streamlining and optimizing decision-making processes	Roger (2020)

Table 2: Dependent variable and item descriptions

Dependent variable: Performance of public universities (PrPUn)		
Measurement scales	**Item code**	**References/Authors (year)**
Improvement and Modernization of Services	ImMSer	Bouaziz and El Manouar (2022)
Improving the User Experience	ImUEx	World Bank (2022)
Reduced Processing Time and Delays	ReTiD	Lamatsch (2023), Khare and Singh (2010)
Improving Transparency and Governance	ImTrGov	Naciri (2023)
Reducing Administrative Costs	ReAdC	Lamatsch (2023), Schwab (2020), Khare and Singh (2010)
Support for Territorial Development	SoTrDv	El Filali and El Moujadidi (2022), Hanna (2021)
Reducing government spending	ReGoS	Ettahiri and Benazzou (2022)
Improving the social aspect of universities	ImSoAs	Satry and Belkadi (2019)
Quick access to information	QAInf	Tarafdar et al. (2015)
Equal treatment	EqTrt	El Belghiti and El ABBADI (2024)

(economic, commercial, technical and financial). In this regard, the operationalization of this variable requires vigilance on the part of the researcher. The choice of items used in the measurement of latent variables was developed and based on solid economic literature, as analyzed by the works presented in Table 2.

After operationalizing the dependent variable, the next step is to discuss the operationalization of the other two variables (independent and Mediating) that make up the research model.

Table 3: Independent and mediating variables definition

Independent variable (Adoption of digitalization: AdDg)		
Measurement scales	**Item code**	**References/authors (year)**
Automation	AUT	Boudreau (2009)
Dematerialization	DEM	Ait Errays and Tourabi (2021)
Disintermediation	DIS	Ait Errays and Tourabi (2021)
Infrastructure and technological resources	ITR	Dhoumi and Zahrane (2024)
Human skills training	HST	Westerman et al. (2011)
Acceptance of change	AC	Naciri (2023)
Decision autonomy	DeAut	Boussouf (2021)
Adaptation of the regulatory framework	ARF	Nokhaili and Ait Lemqeddem (2024)
Mediating variable: Technological innovation (TI)		
Collection of Meta-data	CMD	Westerman et al. (2011)
Use of AI	UIA	Westerman et al. (2011)
Information Technology	IT	Westerman et al. (2011)

3.2. Measurement of Independent and Mediating Variables

In the literature, the adoption of digitalization within public organizations must be understood as a comprehensive project, dependent on a set of elements and prerequisites, as illustrated in Table 3 below.

The mediating variable is a construct that intervenes in a relationship in order to transmit the impact of an independent variable on a dependent variable as indicated by Baron and Kenny (1986), Shrout and Bolger (2002). In this study, technological innovation (mediating variable) was operationalized based on the Covin and Slevin (1989) scale, which consists of three essential items as presented in the Table 3 above.

After designing the conceptual model, it is necessarily need to test it against reality in the field. This step is essential in order to verify the research hypotheses as shown in the following Figure 2.

3.3. Presentation of the Study Sample

As already indicated, through this empirical study, the purpose is to analyze the impact of the adoption of digitalization on the performance of Moroccan public universities, considered as actors of territorial development. To achieve this, the study targeted the stakeholders of these universities. Accordingly, in order to access the field of study, a sample of 106 people (n = 106) was mobilized, composed of three categories of respondents: teacher-researchers, doctoral students and PhD holders, and administrative and technical staff from the twelve Moroccan public universities.

The questionnaire administered as part of this study is divided into three main parts: The first section is dedicated for collecting general data about respondents. The second section aims to determine the nature of the relationship between the constructs used in the conceptual model. Finally, the third section consists of proposals based on the respondents' field experience, with the aim of identifying innovative solutions for the development and improvement of the global ranking of public universities, while exploiting the benefits of digitalization.

3.4. Data Collection Technique

In the following sections, focus will be on determining the scientific approach adopted for collecting the data necessary to address the issue raised. Drawing inspiration from similar research, a questionnaire survey was used as a tool for collecting field data. Extracted from existing literature, all 23 items were measured by using a 5-point Likert scale (1 = Strongly disagree; 5 = Strongly agree).

Moreover, a number of authors, such as Babakus and Boller (1992), reveal that the dimensions included in a questionnaire must be adapted to each specific case. In this study, the questionnaire consists of closed questions with a set of predefined response options. The questionnaire for this study was administered online, which remains a faster and less expensive method of data collection as noted by Thiétart (2014). Before being put online, the questionnaire was pre-tested. The feedback received confirmed the validity of its content, leading to minor adjustments. This step is crucial to ensure high-quality and reliable data collection as noted by Bourgeois et al. (2023).

4. RESULTS AND DATA ANALYSIS

Following the distribution of the online questionnaire via Google Forms from October 04 to November 06, 2025 (37 days), a total of 106 responses were received out of 200 questionnaires distributed, representing a response rate of over 53%. Working with final sample collected and encoded, the objective is to analyze the relationships between the variables in the research model. To test the related hypotheses, the PLS-SEM approach is employed, following three steps that mark the field data analysis process by Smart PLS 4.0 software.

4.1. Descriptive Statistical Analysis

Sekaran and Bougie (2016) emphasize that the purpose of descriptive analysis is to collect information that characterizes the issue under study. Using JASP software, the descriptive analysis focuses on the socio-demographic data obtained in the first section of the questionnaire.

4.2. Distribution by Gender

Analysis of the final sample by gender reveals different characteristics in the results obtained, as shown in Table 4 below:

From a descriptive perspective, analysis of the data presented in Table 4 highlights that the sample studied consists mainly of male respondents (83.01%), while female respondents represent only 16.99% of the study population.

4.3. Distribution by Category

This type of distribution is very important, demonstrating that this study attracted the attention of key stakeholders at Moroccan public universities, as shown in Table 5 below.

Analysis of the sample of study by category reveals different results. The structure of the respondents shows that the proportion of teacher-researchers is the most represented (24.96%), followed by doctoral students (18.26%).

Table 4: Frequencies for sex of the survey participants

Sex	Frequency	Percent	Valid percent	Cumulative percent
Male	88	83.019	83.019	83.019
Female	18	16.981	16.981	100.000
Missing	0	0.000		
Total	106	100.000		

Table 5: Descriptive statistics by category

Category	Frequency	Percentage	Valid percent	Cumulative percent
Doctor	15	14.151	14.151	14.151
Administrative and technical staff	25	23.585	23.585	37.736
PhD student	23	21.698	21.698	59.434
Research professor	43	40.566	40.566	100.000
Missing	0	0.000		
Total	106	100.000		

Table 6: Descriptive statistics by universitie

Home institution	Frequency	Percent	Valid percent	Cumulative percent
Abdelmalek Essaadi University – Tetouan	1	0.943	0.943	0.943
Cadi Ayyad University – Marrakech	3	2.830	2.830	3.774
Chouaib Doukkali University – El Jadida	1	0.943	0.943	4.717
Hassan I University – Settat	1	0.943	0.943	5.660
Hassan II University – Casablanca	3	2.830	2.830	8.491
Ibn Tofail University – Kenitra	4	3.774	3.774	12.264
Ibn Zohr University – Agadir	1	0.943	0.943	13.208
Mohamed I University – Oujda	1	0.943	0.943	14.151
Mohamed V University – Rabat	2	1.887	1.887	16.038
Moulay Smail University – Meknes	18	16.981	16.981	33.019
Sidi Mohammed Ben Abdellah University – Fez	4	3.774	3.774	36.792
Sultan Moulay Slimane University – Beni Mellal	67	63.208	63.208	100.000
Missing	0	0.000		
Total	106	100.000		

4.4. Distribution by University

After surveying a population of 106 participants, Table 6 summarizes the descriptive statistics for the different universities represented among the respondents to the questionnaire included in this study.

Analysis of the data by participants' university affiliation indicates that all Moroccan public universities are represented in this study. The results in Table 6 illustrates the predominance of Sultan

Moulay Slimane University in Beni Mellal, which accounts for more than 63% of the study population, followed by Moulay Smail University in Meknes, with a percentage of 17%.

4.5. Analysis using Structural Equations Method

In order to identify the complex relationship between the variables in the initial model, this study adopts PLS-SEM method, which is considered the most appropriate for this purpose. Many researchers have recommended the relevance of the PLS-SEM method for simultaneously analyzing and testing complex relationships in a research model consisting of multiple exogenous and endogenous latent variables as noted by Roussel (2005). The decision to choose this method implies that the researcher must follow a process based on two main steps: assessment of measurement model and structural model.

4.6. Assessement of Measurement Model

This type of evaluation is based on preliminary testing, allowing researchers to verify the reliability and validity of measurement scales before moving on to evaluating the quality of the structural model.

4.6.1. Reliability analysis and convergent validity

Before proceeding with the evaluation and analyzing the structural model, it is necessary to verify the reliability and quality of information of the indicators used in the measurement of latent and mediating variables. To determine which measurement indicators to use in developing the research model, the researcher must perform a number of tests recognized in PLS-SEM modeling.

To get an idea of the measurement scales for latent variables, a set of statistical tests was performed. Table 7 below summarizes the results of this analysis in detail:

The decision to eliminate or retain items depends on their internal consistency and representativeness within the research model. The results shown in Table 7 support that the dependent, mediating, and all independent variables have a Cronbach's alpha >0.7, a composite reliability (CR) >0.7, and an average variance extracted (AVE) >0.5, which meets the scientific standards established and required by Hair et al. (2019). Furthermore, the factor loadings for each item have a scientifically supported value, exceeding the recommended threshold of 0.7.

4.6.2. Discriminant validity

This test aims to verify whether the constructs and their measurement indicators differ from one another, in accordance with the recommendations of Bagozzi and Phillips (1991). To realize this, the authors propose applying a test based on the use of the Fornell and Larcker (1981) matrix criterion, as presented in Table 8 below:

Table 8 confirms that Fornell and Larcker's criterion is encouraging, since the square root of the AVE of each latent variable is greater than the correlations it shares with other latent constructs (inter-variables), confirming the discriminant validity in the model. In addition, discriminant validity is assessed by another complementary test based on the assessment of the Heterotrait-monotrait ratio (HTMT), the results of which are shown in Table 9 below:

The results presented in Table 9 above confirm that discriminant validity has been verified. According to the standards set by Hair et al. (2014), all HTMT values are well below the critical threshold of 0.9, indicating that the indicators measure different concepts. By removing the problematic items, all of the tests performed using the PLS-SEM method confirm the quality and robustness of the various measurement indicators used in this study, as outlined in the overall model below (Figure 3).

4.7. Assessement Structural Model and Testing Hypotheses

After the validation of the measurement model, the second stage of using PLS-SEM method will be conducted. By applying the

Table 7: Composite reliability and convergent validity results

Constructs and items	Factor loadins	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
AdDg					
AC	0.796	0.907	0.913	0.925	0.608
ARF	0.822				
AUT	0.771				
DEM	0.719				
DIS	0.702				
DeAut	0.741				
HST	0.842				
ITR	0.832				
PrPUn					
ImMSer	0.813	0.855	0.872	0.895	0.630
ImTrGov	0.724				
ImUEx	0.791				
QAInf	0.825				
ReTiD	0.811				
TI					
CMD	0.818	0.800	0.818	0.881	0.713
IT	0.866				
UIA	0.848				

Bootstrapping technique, the objective is to empirically test the causal relationships between latent and mediating variables, in line with the findings of Leguina's research (2015).

4.7.1. Coefficient of determination

The value of the coefficient of determination (R^2) expresses the proportion of variability explained by the model. This test is performed to evaluate the explanatory power of the model, with the aim of justifying the quality of the endogenous constructs. Referring to the work of Hair et al. (2017) as reported in Table 10, three reference thresholds for the value of the coefficient of determination are proposed to judge the relevance of latent variables.

Table 8: Discriminant validity test (Fornell Larcker criterion results)

Latent variables	AdDg	PrPUn	TI
AdDg	0.780	----------	----------
PrPUn	0.217	0.665	----------
TI	0.588	0.298	0.844

Table 9: The Heterotrait-monotrait ratio results

Latent variables	Heterotrait-monotrait ratio (HTMT)
PrPUn <-> AdDg	0.218
TI <-> AdDg	0.672
TI <-> PrPUn	0.342

Theoretically, the coefficient of determination ranges between 0 and 1 with the minimum threshold recommended by Hair et al. (2017a, b), being 0.10 (Falk and Miller, 1992). The Table below presents the values of the coefficient of determination R^2 (R-square) associated with the dependent variables in the research model. As shown in Table 11, the results obtained confirm that the model studied presents an acceptable fit.

4.7.2. Collinearity test (VIF)

This test is based on detecting constraints associated with independent variables that have been shown to influence the model and impair its quality. The variance inflation factor (VIF) is a criterion that allows researchers to check for multicollinearity in the model, as shown in the Table 12 below.

In the literature, the VIF value for each variable must be <3 and must not exceed the maximum threshold of 5 according to Hair et al. (2020) and Latan and Ghozali (2015). As a result, all VIF values are <3, indicating the absence of multicollinearity. Furthermore, by applying the VIF test, the results indicate that

Figure 2: Proposed conceptual model of structural equation modelling research

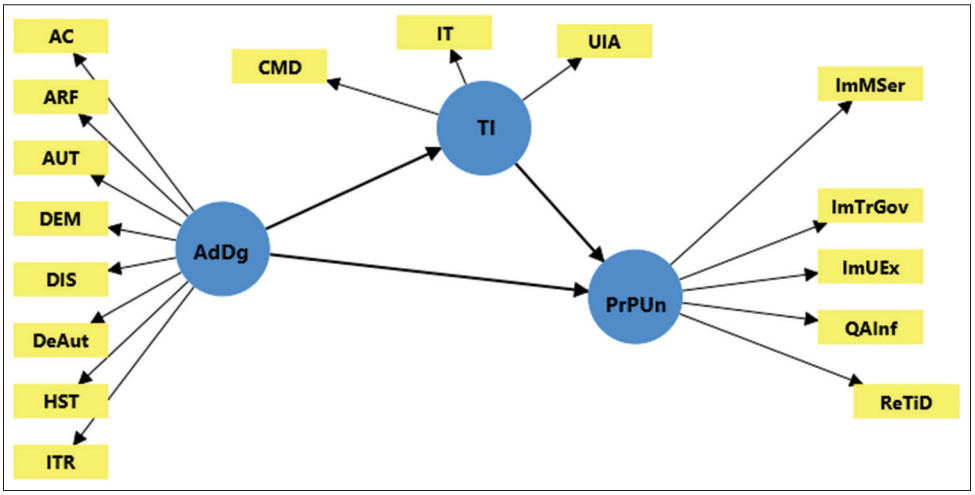
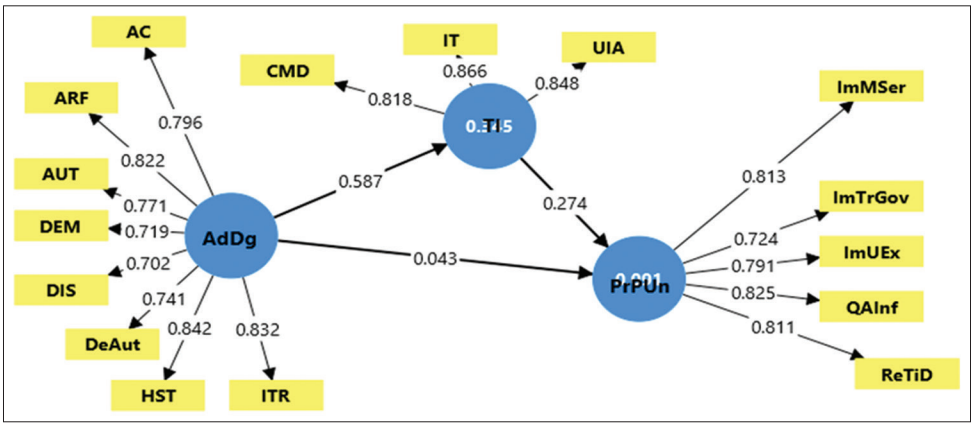


Figure 3: The structural adjusted model with the mediator (PLS-SEM)



the structural model is valid, hence the quality and validity of the overall model (Table 12).

4.7.3. Effect size (f^2)

Firstly, this index, introduced by Cohen (1988), is a mechanism that allows researchers to evaluate the contribution of each endogenous variable in the structural model. In this perspective, Hair et al. (2020) divides the magnitude of this effect into three values: 0.02 (small effect), 0.15 (medium effect), and 0.35 (large effect).

In this study, using the PLS Algorithm technique, the Table 13 below highlights the results relating to the calculation of the f-square coefficient (f^2) between variables.

Looking at the results presented in Table 13, it can be observed that the magnitude of the effect of digitalization adoption on the performance of public universities remains low, with a value of $f^2 = 0.001$. The implementation of digitalization has a significant effect on technological innovation, with a large effect coefficient of $f^2 = 0.527$. Finally, the magnitude of the effect of technological innovation on the performance of public universities is substantial, as reflected in the value of $f^2 = 0.054$.

4.8. Hypothesis Testing

The purpose of this scientific work is to validate the research model and empirically test the hypotheses formulated at the outset. Table 14 shows a summary of the results obtained.

Table 10: Thresholds for the coefficient of determination R^2

Values	R^2>0.67	R^2>0.33	R^2>0.19
Judgment	Substantial	Moderate	Weak

Table 11: R-Square results

Constructs	R-square	Adjusted R-square	Observation
PrPUn	0.091	0.073	Very low but acceptable
TI	0.345	0.339	Moderate

Table 12: The collinearity of variables

Structural relationships	Variance inflation factor (VIF)	Result
AdDg -> PrPUn	1.527	No multi-collinearpractity
AdDg -> TI	1.000	
TI -> PrPUn	1.527	

Table 13: Effect size (f^2) determination

Relationship	F-square	Effect size
AdDg -> PrPUn	0.001	Low
AdDg -> TI	0.527	Very high
TI -> PrPUn	0.054	Low

Using the bootstrapping analysis, the Table 14 above provides the results obtained in the presence of the mediating variable. Based on the results in this Table, the hypothetical relationships were formulated are statistically confirmed, as indicated by the values of P smaller than 0.05 and t-statistic value more than 1.96.

4.9. Mediating Role of Technological Innovation

In order to assess the significance of the structural relationships between the variables in the model, it is necessary to calculate the value of the variance accounted for (VAF). This calculation is performed using the following formula: VAF = (indirect effect)/(total effect).

In practical terms and in this study: VAF = (0.587 × 0.274)/(0.043 + [0.587 × 0.274]) = 0.160/0.203 = 0.78.

The main objective of this study is to confirm or refute the existence of structural links between the variables in the model, specifically identifying the effect of the mediating variable. The verification of the research hypotheses is fundamentally based on the calculation of a number of values, such as the probability of error (P-value), path coefficients, etc.

As show in Table 15, the results obtained corroborate the theoretical contributions mentioned above and the three research hypotheses. As a relevant conclusion, these results demonstrate the presence of a positive relationship between the Implementation of digitalization and the performance of services offered by Moroccan public universities.

Following the calculation, the direct impact of the adoption of digitalization on the performance of Moroccan public universities was relatively low ($\beta = 0.043$, $t = 2.913$, $P \leq 0.05$). Indeed, the indirect effect (mediating effect) of the adoption of digitalization on the performance of Moroccan public universities, mediated by technological innovation, is positive ($\beta = 0.16$) and statistically significant ($P < 0.05$). The associated confidence interval is (0.25, 0.975), which does not contain the value 0. Therefore, this result confirms the existence of a mediating effect, in accordance with methodological standards for analyzing the effect of the mediated variable in PLS-SEM modeling (Figure 4).

5. DISCUSSION

This work is part of research into assessing the impact of digitization on the performance of public institutions. In practice this study, conducted on a sample of 106 respondents, examined the impact of digitalization on the performance of Moroccan public universities. The results highlight the central role that digitalization

Table 14: Direct impact and hypotheses testing results

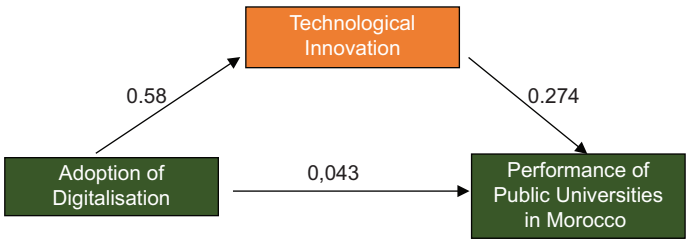
Relationship and research hypotheses	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	Path coefficient (β)	T statistics (|O/STDEV|)	P-values	Decision
AdDg ->PrPUn (H_1)	0.204	0.220	0.104	0.043	1.96	0.050	Accepted
AdDg -> TI (H_2)	0.587	0.594	0.064	0.587	9.223	0.000	Accepted
TI -> PrPUn (H_3)	0.274	0.285	0.118	0.274	2.313	0.021	Accepted

*The value is significant at the 0.05 level

Table 15: Direct, indirect, and total effects

Structural relationship	Direct effect	Indirect effect	Total effect	VAF (%)	Type of mediation
AdDg -> TI -> PrPUn	0.043	0.16	0.20	**0.78** (20<78<80)	Partial

Figure 4: Mediation analysis



plays in improving the performance of public services provided by these universities through:

1. Improvement and modernization of services;
2. Improving the user experience;
3. Reduced processing time and delays;
4. Improving transparency and governance;
5. Quick access to information.

In addition, our conclusions were drawn regarding the partial mediating effect of technological innovation on the relationship between the adoption of digitalization and the performance of Moroccan public universities. The results of this study highlight important conclusions. Based on these findings, the research hypotheses were also supported, confirming the existence of a positive synergy between the adoption of digitalization and the performance of Moroccan public universities ($\beta = 0.043$, $t = 1.96$, $P < 0.05$). In parallel, it was found that technological innovation has a partial mediating effect on the relationship between digitalization and the performance of the services provided by these universities ($\beta = 0.16$, $P < 0.05$).

Compared to previous literature, the results obtained are consistent and convergent with the past literature conclusions and theoretical contributions underlying this study, particularly those of El Haddah et al. (2023). As noted by these authors, the adoption of digital and techniques solutions constitutes a strategic roadmap for developing a more efficient digital administration capable of ensuring and offering quality services to users.

Our study contributes to the existing literature on the impact of digitalization on performance universities by providing relevant findings that are consistent with previous research (Ahmed, 2025; Javed et al., 2025; ILCUS, 2018). Their contributions show that technological transformation and innovation have a positive and significant impact on improving public performance, which is consistent with the conclusions drawn from our study.

Furthermore, our results corroborate with others works, including Nadkorokoum (2024), which highlights that the digitization of public services in Africa has a positive influence on administrative efficiency and performance, contributing to faster service delivery and lower administrative costs, while improving citizen satisfaction.

Engku's (2025) research also highlights the important role of digitalization in improving employee responsiveness and engagement, particularly when accompanied by clear communication and adequate training, while taking into account resistance to change that could compromise the functioning of public organizations. These findings support the results of our study.

Moreover, the findings of this study are consistent with the conclusions drawn from others research (Antonopoulou et al., 2023), who consider the promotion of technologies to be a strategy that facilitates the adaptation of value-creating functionalities and supports organizational change. Finally, the work of Guenduez et al. (2025) confirms that technological innovation strategies focused on continuous improvement are the most effective, particularly for process optimization and organizational change management. They are in line with the outcomes of our study.

6. CONCLUSION AND FUTURE RESEARCH

By making a series of contributions to the existing literature, this scientific article focused primarily on analyzing the role of technological innovation in mediating the influence of the adoption of digitalization on the performance of Moroccan public universities. This study reviewed the literature of previous of theoretical and empirical research that analyzed the relationship between the adoption of digitalization and the performance of public organizations. It has been confirmed that there is an interaction between the variables in the research model. Empirically, data were collected by the survey method from 106 participants, including faculty members, administrative and technical staff, and doctoral students from twelve Moroccan public universities. The analysis of the results, enabled us to test and verify the initial research hypotheses. Indeed, the findings of this study confirm the presence of the following structural relationships:

- The adoption of digitalization has a low positive direct impact on the performance of Moroccan public universities, confirming the first hypothesis (H_1);
- The second hypothesis (H_2) is accepted, suggesting that the adoption of digitalization is positively associated with technological innovation within Moroccan public universities;
- The relationship between the implementation of digitalization and the performance of Moroccan public universities is partially mediated by the strengthening of technological innovation. Consequently, the mediating hypothesis (H_3) is supported.

Overall, the results obtained from this confirmatory quantitative study are consistent with empirical findings and underlying theoretical foundations. Therefore, these results have important theoretical contributions and managerial implications, contributing to the enrichment of the scientific community. From a practical

and managerial contributions, it appears important that managers of Moroccan public universities should pay considerable attention to digitalization in order to improve the efficiency of the services provided by these actors of territorial development. Furthermore, it is desirable that these decision-makers support and strengthen digitalization within these universities, while targeting all areas of activity of these institutions (governance, scientific research, training, finance, international cooperation, etc.). On the other hand, a culture of digital adoption promotes transparency, encourages responsiveness, and facilitates organizational change with the ultimate goal of contributing to the development of their host territories. Furthermore, managers of Moroccan public universities are required to embed digitalization in the projects they prepare for the development of these institutions. The latter must promote the strengthening of technological innovation in order to provide quality services to users and for the sake of enhancing the services of the Moroccan higher education system.

However, despite its significant contributions, this research has some limitations that require further study and in-depth investigation. Methodologically, data were collected by using questionnaire and this study favored a quantitative approach. From a development perspective, it would be excellent to adopt another methodological approach by conducting qualitative with interview guide and comparative studies that could lead to more concrete and different findings.

Additionally, the sample of this study consisted of only 106 respondents. Therefore, as a follow-up to this research, the sample size of this study could be expanded to include other public sectors in order to strengthen the external validity and generalizability of the results obtained to other contexts. This approach could also produce new, solid, and reliable scientific knowledge.

REFERENCES

Ahmed, N. (2025), Digital transformation strategy and faculty performance in Omani universities: The mediating role of digital transformation. Problems and Perspectives in Management, 23(3), 700-714.

Ait Errays, N., Tourabi, A. (2021), An attempt to understand the success factors of digital transformation projects. Moroccan Journal of Entrepreneurship Innovation and Management, 6(1), 45-66.

Antonopoulou, K., Begkos, C., Zhu, Z. (2023), Staying afloat amidst extreme uncertainty: A case study of digital transformation in higher education. Technological Forecasting and Social Change, 192, 122603.

Arvanitis, S., Sydow, N., Woerter, M. (2008), Is there any impact of university–industry knowledge transfer on innovation and productivity? An empirical analysis based on Swiss firm data. Review of Industrial Organization, 32(2), 77-94.

Babakus, E., Boller, G.W. (1992), An empirical assessment of the SERVQUAL scale. Journal of Business Research, 24(3), 253-268.

Bagozzi, R.P., Yi, Y., Phillips, L.W. (1991), Assessing construct validity in organizational research. Administrative Science Quarterly, 36(3), 421-458.

Baron, R.M., Kenny, D.A. (1986), The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. Journal of Personality and Social Psychology, 51(6), 1173-1182.

Barney, J. (1991), Firm resources and sustained competitive advantage. Journal of Management, 17(1), 99-120.

Benjouid, Z., Zineb, A., Eddine, B.S. (2024), The Digital Transformation as a Lever for Territorial Development - Case Study of an Urban Municipality. In: Proceedings of Mediterranean Smart Cities Conference (MSCC). p1-6.

Bharadwaj, A.S. (2000), A resource-based perspective on information technology capability and firm performance: An empirical investigation. MIS Quarterly, 24(1), 169-196.

Bouaziz, F., El Manouar, A. (2022), Digital Government in Morocco: Challenges and Opportunities. International Journal of Public Administration in the Digital Age, 9(1), 15-30.

Bourgeois, I., Buetti, D., Maltais, S. (2023), Foundations and Contemporary Practices in Program Evaluation. Ottawa: Universite d'Ottawa.

Bourguignon, A. (1995), Defining performance: A simple question of vocabulary. Revue Française de Comptabilité, 269, 61-65.

Boudreau, C. (2009), Qualité, efficience et efficacité de l'administration numérique à l'ère des réseaux: L'exemple québécois. Revue Française D'administration Publique, 131(3), 527-539.

Boussouf, Z. (2021), Gestion et Evaluation De La Performance Des Universités publiques Marocaines: Une Approche Par Les Parties Prenantes Cas De L'universite Sidi Mohamed Ben Abdellah De Fes. Thèse En Sciences De Gestion. Université Sidi Mohammed Ben Abdellah.

Busch, P.A., Eikebrokk, T.R. (2019), Digitizing Discretionary Practices in Public Service Provision: An Empirical Study of Public Service Workers Attitudes. In: Proceedings of the 52nd Hawaii International Conference on System Science.

Chae, H.C., Koh, C.E., Prybutok, V.R. (2014), Information technology capability and firm performance: Contradictory findings and their possible causes. MIS Quarterly, 38(1), 305-326.

Cohen, J. (1988), Statistical Power Analysis for the Behavioral Sciences. 2nd ed. Hillsdale, NJ: Lawrence Erlbaum.

Covin, J.G., Slevin, D.P. (1989), Strategic management of small firms in hostile and benign environments. Strategic Management Journal, 10(1), 75-87.

Creswell, J.W. (2014), Research Design: Qualitative, Quantitative, and Mixed Methods Approach. 4th ed. London: SAGE Publications.

Dhoumi, A., Zahrane, T. (2024), Digitalisation et attractivité entrepreneuriale des territoires: Essai de conceptualisation. Revue Publicité Communication Marketing (RPCoM), 2, 28-42.

DiMaggio, P.J., Powell, W.W. (1983), The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields. American Sociological Review, 48(2), 147-160.

Du Plessis, M. (2007), The role of knowledge management in innovation. Journal of Knowledge Management, 11(4), 20-29.

El Belghiti, R., El Abbadi, A. (2024), The effect of the digitalization of public services provided by the municipality of Kenitra on perceived quality. International Journal of Accounting Finance Auditing Management and Economics, 5(8), 592-608.

El Filali, A., El Moujadidi, N. (2022), Digitalization and local development in the Moroccan territorial context: Current situation and prospects. International Journal of Management Sciences, 5(2), 793-818.

El Haddah, H., Chafik, K., Mghizou, H. (2023), Technological trends in the digital transformation of tax administrations at the international level: Literature review and overview of the situation in Morocco. European Scientific Journal, 19(19), 68-86.

EL Hajjam, C. (2023), Higher education in Morocco: State of internationalization. Djiboul, 5(3), 14-27.

Engkus, E. (2025), The impact of digital transformation on public sector organizational commitment: A case study of public management practices. Edelweiss Applied Science and Technology, 9(2),

2256-2269.
Ettahiri, L., Benazzou, L. (2022), La digitalisation au service de la performance de l'administration fiscale au Maroc: Cas de la mobilisation des recettes fiscales. International Journal of Accounting Finance, Auditing Management and Economics, 3(2-1), 120-136.
Falk, RF., Miller, N.B. (1992), A Primer for Soft Modeling. Akron, OH: University of Akron Press.
Fayol, H. (1916), Industrial and General Administration. Paris: Dunod.
Fornell, C., Larcker, D.F. (1981), Evaluating structural equation models with unobservable variables and measurement error. Journal of Marketing Research, 18, 39-50.
Gagnol, L., Hérault, J.L. (2001), Regional economic impact of a university hub: Application to the case of Strasbourg. Revue d'Economie Régionale et Urbaine, 4, 581-604.
Guenduez, A.A., Demircioglu, M.A., Mueller, E.M., Cinar, E. (2025), Digital innovation strategies in the public sector. Research Policy, 54(8), 105274.
Hair, J.F., et al. (2017b), An updated, and expanded assessment of PLS-SEM in information systems research. Industrial Management and Data Systems, 117(3):442-458.
Hair, J.F., Risher, J.J., Sarstedt, M., Ringle, C.M. (2019), When to use and how to report the results of PLS-SEM. European Business Review, 31(1), 2-24.
Hair, J.F., Jr. et al. (2014), A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM). California: Sage Publications.
Hair, JF., Howard, M.C., Nitzl C. (2020), Assessing measurement model quality in PLS-SEM using confirmatory composite analysis. Journal of Business Research, 109, 101-110.
Hanna, N. (2021), A Digital Government for Africa: Pathways to Transformation. London: Routledge.
Ittner, C.D., Larcker, D.F. (1998), Are Nonfinancial Measures Leading Indicators of Financial Performance? An Analysis of Customer Satisfaction. Journal of Accounting Research, 36, 1-35.
Ilcus, M.A. (2018), Impact of digitalization in business world. Review of International Comparative Management, 19(4), 350-358.
Janowski, T. (2015), Digital government evolution: From transformation to contextualization. Government Information Quarterly, 32(3), 221-236.
Javed, T., Azhar, J., Shabbir, M.F., Nasir, A. (2025), Sustainable performance in public sector universities of Punjab: Examining the moderating impact of digital leadership amid digital transformation and innovativeness. Discover Sustainability, 6, 934.
Kaplan, R.S., Norton, D.P. (1996), The Balanced Scorecard: Translating Strategy into Action. India: Harvard Business Press.
Khare, A., Singh, S. (2010), Antecedents to Indian customers attitude towards online insurance services. International Journal of Business Competition and Growth, 1(1), 19.
Lamatsch, H. (2023), Digital transformation of administration: The quest for efficiency and agility. Revue Défense Nationale, H13, 77-90.
Latan, H., Ghozali, I. (2012), Partial Least Squares: Concept, Technique, and Application Using Smart PLS 2.0. Semarang: Diponegoro University Press.
Leguina, A. (2015), A primer on partial least squares structural equation modeling (PLS-SEM). International Journal of Research and Method in Education, 38(2), 220-221.
Lucas, R.E. (1988), On the mechanics of economic development. Journal of Monetary Economics, 22, 3-42.
Marginson, S. (2007), Global university rankings: Implications for public policy. Academy of Management Perspectives, 21(1), 36-54.
Marion, A., Asquin, A., Everaere, C., Vinot, D., Wissler, M. (2012), Diagnostic De La Performance De L'entreprise: Concepts et Méthodes. France: Dunod.
Mergel, I., Edelmann, N., Haug, N. (2019), Defining digital transformation: Results from expert interviews. Government Information Quarterly, 36, 101385.
Metcalfe, S., Ramlogan, R. (2008), Innovation systems and the competitive process in developing economies. The Quarterly Review of Economics and Finance, 48, 433-446.
Mithas, S., Tafti, A., Jie Mein Goh, I.B., (2012), Information technology and firm profitability: Mechanisms and empirical evidence. MIS Quarterly, 36 (1), 205-224.
Morin E., Guindon M., Boulianne E. (1996), Les indicateurs De performance, Montréal. Guérin: Ordre Des Comptables Generaux Licencies Du Quebec.
Musselin, C. (2001), The Long March of French Universities. Paris: Presses universitaires de France.
Naciri, A. (2023), Les Systemes D'information Et La Performance Des Universites Publiques Marocaines : Cas Des Universites De Fes Et Meknes [Thèse De Doctorat]. Université Sidi Mohammed Ben Abdellah, Fès.
Nadkorokoum, C. (2024), Impact of digitalization on the efficiency and performance of public services in Africa: An analysis of challenges and opportunities in the context of the Moroccan health system. Revue Internationale du Marketing et Management Stratégique, 6(2), 1-24.
Nokhaili, H., Ait Lemqeddem, H. (2024), The digitalization of the public sector in morocco: An analysis in the era of good governance and new public management. Revue Economie and Kapital, n25, 39-63.
Organisation for Economic Co-operation and Development. (2019), Going Digital: Shaping Policies, Improving Lives. Paris: OECD Publishing.
Ory, J.F. (2015), Contrôle et Pilotage de la Performance Globale Des Universités. Une Approche Par Les Parties Prenantes: l'Exemple du Développement Durable. Gestion et Management. Université de Reims Champagne-Ardenne; [Thése de Doctorat].
Ouajdouni, A., Chafik, K., Boubker, O. (2020), Digital transformation of public administration in morocco: Literature review and current status. European Scientific Journal, 16(19), 406-432.
Roger, A. (2020), L'essentiel De La Theorie Des Organisations. 12th éd. Italy: Gualino.
Roussel, P. (2005), Méthodes de développement d'échelles pour questionnaires d'enquête. In: Roussel, P., Wacheux, F., editors. Management des Ressources Humaines: Méthodes de Recherche en Sciences Humaines et Sociales. Ch. 9. De Boeck: Lacier Université. p245-276.
Satry, F., Belkadi, E. (2019), Study of the determinants of citizens' use of E-government services: Literature review. European Scientific Journal, 15(4), 284-307.
Scaringella, L., Radziwon, A. (2018), Innovation, entrepreneurial, knowledge, and business ecosystems: Old wine in new bottles? Technological Forecasting and Social Change, 136, 59-87.
Schwab, K. (2020), The Fourth Industrial Revolution and Public Administration. New York: World Economic Forum.
Scott, S.V., Van Reenen, J., Zachariadis, M. (2017), The long-term effect of digital innovation on bank performance: An empirical study of SWIFT adoption in financial services. Research Policy, 46(5), 984-1004.
Sekaran, U., Bougie, R. (2016), Research Methods for Business: A Skill-Building Approach. 7th ed. , West Sussex: Wiley and Sons.
Shrout, P.E., Bolger, N. (2002), Mediation in experimental and nonexperimental studies: New procedures and recommendations. Psychological Methods, 7(4), 422-445.
Ştefănescu, A., Dobrin, C., Calu, D.A., Ţurlea, E. (2010), Controverse privind măsurarea performanţei entităţilor administraţiei publice din România. Revista Transilvană de Ştiinţe Administrative, (1), 225-242.
Stolterman, E., Fors, A. (2004), Information technology and the good life. In: Kaplan, B., Truex, D.P., Wastell, D., Wood-Harper, A.T., DeGross, J.I., editors. Information Systems Research. IFIP

International Federation for Information Processing. Vol. 143. Berlin: Springer. p687-692.

Taouab, O., Issor, Z. (2019), Firm performance: Definition and measurement models. European Scientific Journal, 15(1), 93-106.

Tarafdar, M., Pullins, E.B., Ragu-Nathan, T.S. (2015), Technostress: Negative effect on performance and possible mitigations. Information Systems Journal, 25(2), 103-132.

Thiétart, R.A. (2014), Méthodes De Recherche En Management. 4théd. France: Dunod.

Westerman, G., Calméjane, C., Bonnet, D., Ferraris, P., McAfee, A. (2011), Digital transformation: A road-map for billion-dollar organizations. The MIT Center for Digital Business and Capgemini Consulting, 52(1), 1-38.

World Bank. (2022), Digital Transformation in MENA Public Administration: Case of Morocco; [World Bank Reports].