Digital transformation strategy in Algerian university institutions as a requirement for achieving digital sustainability in university of algeria-casa university of ghardaia

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Summary: This study aims to know the extent of the contribution of digital transformation in achieving digital sustainability at the Faculty of Sciences Economic, Commercial and Management Sciences at the University of Ghardaia, and to achieve the objective of the study, the descriptive method
was adopted in the framework of the theoretical presentation, the analytical method and the case study method in the applied aspect, while the questionnaire was used as the main tools of the study on a sample estimated at (68) individuals consisting of professors and administrators at the faculty in addition to conducting an interview to support the study, and in the end we reached a set of results, most importantly: The level of digital transformation and digital sustainability in the college is assessed as medium in general due to the measurement of the specified dimensions, while regarding the relationship and impact, the results proved that there is a statistically significant positive and moderate direct correlation for digital transformation and digital sustainability, through these results we propose some recommendations: Recommendations related to enhancing digital transformation are to give high priority to improving and developing the infrastructure while increasing the speed of the Internet within the campus, developing plans to attract and hire specialized competencies in the field of digitization according to the actual needs of the university, and recommendations related to achieving digital sustainability are to develop clear policies and procedures for managing digital information from its creation until it is archived or destroyed, with a focus on updating content regularly and ensuring its accessibility and reliability.

Keywords: Strategy, transformation, sustainability, digital, college, university, internet, information.
Jel Classification Codes : T1 ; D1 ; R1 ; S1 ; A1

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I-Introduction:

In recent years, the concept of digital transformation has emerged as a strategic imperative for higher education institutions seeking to adapt to rapid technological advancements and evolving societal needs. Universities worldwide are increasingly recognizing the necessity of integrating digital tools and frameworks to enhance institutional performance, educational quality, and administrative efficiency. Within this context, digital sustainability—defined as the ability of institutions to maintain and evolve digital systems in a way that supports long-term educational goals—has become a key objective.

Algerian university institutions, like their global counterparts, are navigating the challenges and opportunities presented by digital transformation. However, the extent to which these institutions are strategically implementing digital transformation to achieve sustainable digital development remains underexplored. This study investigates the role of digital transformation strategy in

fostering digital sustainability, with a specific focus on the Faculty of Economics, Business and Management Sciences at the University of Ghardaia.
The research aims to assess the current state of digital transformation and its impact on digital sustainability within this academic context. By employing a mixed-methods approach, including surveys, interviews, and a case study analysis, the study seeks to identify strengths, gaps, and actionable recommendations for enhancing the digital future of Algerian universities.
Given the vital role that digital transformation plays in university institutions with digital sustainability, we have studied this type of important topics, and in order to have a broader understanding of the various aspects, the following question was posed:

To what extent does digital transformation in its dimensions contribute to the realization of digital sustainability at the Faculty of Economic Sciences and Management Sciences at the University of Ghardaia?

A- Objectives of the study:
Based on the study issue, the objectives of the study were defined as follows:
1. Provide a comprehensive vision of the concept of digital transformation, its contents, and how to approach it.
2. Identify the relationship between digital transformation and digital sustainability.
3. Diagnosing the reality of digital transformation at the Faculty of Economics, Business and Management Sciences.
4. Studying the role of digital transformation in achieving the requirement of digital sustainability in the field under study.

I.1. Concept of Digital Transformation
Digital transformation refers to the use of digital technologies to optimize processes, enhance talent engagement and develop new business models" (Ahmed, 2025).
Definition of the European Commission "European Commission" (EC): (an executive branch of the European Union, responsible for proposing legislation, implementing decisions, upholding EU treaties and managing its day-to-day business). (Verina. N, 2019)
Also known as Capgemini: (a French multinational company and global leader in consulting, technology services and digital transformation). .
" Digital transformation has become the key challenge in change management because it affects not only the organization's structures and strategic positioning but all levels of the organization (every function, activity, process) and its extended supply chain". (Wassie, 2021)
Digital transformation is a comprehensive process that includes the transition of the organization from the traditional familiar situation to a more modern situation than it is, by trying to adopt the latest versions of the current technology and mix it with its work methods, strategy and all that contains its internal and external environment of material, moral and human resources, ensuring added value and change for the better.

I.*2*.Digital transformation requirements
There are a set of requirements that must be met in an organization to achieve digital transformation, and they differ from to another organization and can be referred to below **(Wahba Amal, 2022)**:
The digital transformation process must include three main requirements, the first of which is: Determining the appropriate strategy for digital transformation, and secondly: Knowing the work mechanisms available within government organizations and their internal management, and the degree of importance and effectiveness of each of them **(Maryam Abdulaziz, 2023)**: The availability of appropriate training for all interested employees to demonstrate the appropriate for digital transformation and ensure that the right approach is taken within the effective steps .
In addition to the following requirements:

Developing organizational structures: By moving away from complex structures, and seeking to create flexible structures with focusing on effective work teams. **(Abdulrahman Hassan Hassan Mohammed, 2020)**

Spreading the culture of digital transformation: through the participation of faculty members, administrators and students in the digital transformation program while spreading the culture of continuous education and training; **(Amal Zeidan, 2020)**

Legislative requirements: By issuing legislation that allows the ease of digital transformation and meets requirements,

Modernizing legislation and laws to keep pace with the digital transformation environment. **(Mubarka Salem Muftah, 2024)**

- ✓ **Commitment from managers**: It won't work without managers agreeing to the goal and knowing the benefits they will reap from the digital transformation;
- ✓ **Don't limit the technology**: Choosing the right one is one of the most difficult decisions;
- ✓ **Closing the skill gap**: There is often a disparity in the skills required, which is part of the change, so the workforce must be trained and retrained. **(Badriya Mohammed Abdulrahman Al-Shahri, 2023)**

I.3 Obstacles to digital transformation:

- ✓ The digital transformation process within organizations faces many obstacles that affect its goals and direction**, the most important of which are the following:**
- ✓ Lack of competence and capabilities capable of changing and leading the digital transformation program within the organization; (Haitham Ibrahim Al-Masdar, 2020)
- ✓ Lack of budgets allocated for the digital transformation process may limit the achievement of the desired results; (Samia bint Trahaib bin Bayn Al-Otaibi, 2021)
- ✓ Information security risks in light of the use of modern means;
- ✓ Lack of a comprehensive digital strategy.
- ✓ The existence of doubts and lack of confidence among some human resources in their readiness to use digital platforms; (Asmaa Saeed Ahmed Al-Asraj, 2022)
- ✓ The role of digital transformation executives is ambiguous.
- ✓ Lack of vision for how to digitize;
- ✓ Lack of motivation and encouragement for employees to participate in the digital transformation;
- ✓ Lack of clear criteria for evaluating performance in light of the digital transformation.
- ✓ The lack of awareness of the workers that emerge against the application of modern technologies for fear of their positions and their career future.
- ✓ Lack of specialists in the preparation of educational software;
- ✓ Burdening professors with teaching burdens, which negatively affects learning outcomes.
- ✓ Fear of losing control of the educational process;
- ✓ The lack of readiness of some universities for digital transformation, which lacks the necessary digital infrastructure;
- ✓ The challenge of the disparity in access to the Internet and digital technology, as it was found during the development of online lessons during the COVID-19 pandemic that there are shortcomings and sometimes the absence of computers or poor Internet service.
- ✓ Lack of proper planning and training.
- ✓ Weak coordination at the senior management level for digital management programs**.** (Ibtisam Marjan, 2021)
- ✓ Security constraints such as hacking. (Talaq Awadallah Al-Sawat, 2022)

Based on the above, we conclude that in the attempt to move towards digital transformation, it is necessary to face some obstacles, which are represented by obstacles

and challenges, including: Lack of strategy and digital vision, lack of competence and capabilities of human resources, lack of strong infrastructure, lack of coordination, encouragement and awareness among some, resistance to change, lack of allocated budget, and the seniority of some officials leads to heavy tasks sometimes.

I. 4. The Concept of Digital Sustainability:

The term digital sustainability refers to the great potential of digital technologies in contributing to sustainability goals at both micro and macro levels where digitization and sustainability intersect and are driven by the strategic goals of digital transformation and sustainability. (Hamza Ben Zein, 2024)

Digital sustainability is defined as a means of maintaining the infrastructure that supports all the functions of digital objects and encompasses a wide range of technical concerns and issues associated with the creation and management of digital objects that contribute to the longevity of digital information over the entire life cycle. (Hanan Ahmed El-Gendy, 2024)

Digital sustainability can be broadly defined as organizational activities that seek to promote sustainable development goals using technologies that create, use, transmit or store electronic data. Digital sustainability is resilience, which is the ability of a system to maintain or regenerate itself permanently. (Mohammad Kargar Shouraki, 2022)

Based on the above, we conclude that digital sustainability is the modern capabilities that promote the goals of sustainable development and maintain the infrastructure that supports all the functions of digital objects using technology and that have the ability to endure.

I. 5. Indicators to measure digital sustainability:

Most global organizations seek to provide digital sustainability through the availability of some basic indicators in their operations, including:

1) Information: Like many resources, knowledge can be acquired, used for a variety of purposes, and its loss can sometimes be a significant loss to an organization.

2) Innovation: It is the formation of a new idea and for innovation to take place it simply requires a new formulation of existing elements in the organization.

3) Time: Time has an impact on the future of the organization, and in order to manage time effectively, it is preferable to renew and simplify work procedures, eliminate unnecessary steps, or use modern devices and equipment to accomplish work quickly.

4) Digitization: The term digitization refers to the use of technology in the conduct of all the work of the organization.

5) Speed of access: Speed is one of the biggest benefits of the digital economy, in the case of digital sustainability in the business world, and speed starts from the speed of access to information and sharing it with all decision makers within the organization. (Youssef Hajim Sultan Al-Taie, 2016)

From this we conclude that to measure digital sustainability there are five or more indicators, firstly, information, which is the basis of all that takes place in the organization from knowledge, there can be no digital sustainability without information about how to sustain, secondly, innovation helps to revive digital ideas and materialize them in reality and their permanence, thirdly, digitization embodies the use of technology, which is originally part of digital sustainability, fourthly and fifthly, speed of access and time, which express the period of access, survival and continuity or sustainability of digitization, fourthly and fifthly, speed of access and time, which expresses the period of access, survival and sustainability of digitization.

I. 5. The role of digital transformation strategy in achieving digital sustainability in university institutions:

Digital sustainability and digital transformation are both imposing major shifts on our world and how we perceive it. Digital transformation opens up entirely new ways to shape, monitor, and manage digital sustainability as a new global concept. (Peter Seele, 2015)

The integration of sustainable practices enables organizations to drive innovation, reduce costs, and enhance their reputation, meaning it focuses on improving the efficiency of existing systems, and if these systems contribute to digital sustainability, then digital transformation in this context also contributes to sustainability (Rafael Martínez-Peláez, 2025).

The development of teaching and research processes associated with digital resources, platforms, and tools is an ongoing process inside and outside the department, and promoting sustainable educational practices is a core competency that educators must address in the 21st century, as well as learning strategies tha In higher education, there have been calls for more approaches to learning and teaching, where digital sustainability is one of the main drivers of this call, and the challenges of securing space within the "crowded" curriculum and prioritizing learning for sustainability is what pushes higher education into cyberspace, and the transition to online education requires thinking about how to reuse resources used in face-to-face teaching to open horizons and increase enrollment. (Esteban Vazquez -Cano, 2023)

Based on the above, we conclude that the relationship between digital transformation and digital sustainability in university institutions is a complex relationship through the transformation and orientation of university institutions towards all that is digital and modern, here it calls for a relative change in the methods and methods used in education, and through its intensive use of digital technology from modern programs and tools, and to maintain this technology is innovation and development in it to include digital sustainability over the years for all generations to come.

4. Methodology

II .1. Study community: The community of the current study consists of all individuals belonging to the job categories concerned with the research topic at Ghardaia University during the period of conducting the field study for the academic year (2024-2025), and the study community included the following categories: (faculty members, professors, administrative staff).

II 2. Questionnaire sample (quantitative sample):

- ✓ **Selection method**: The questionnaire sample was selected using the simple random sampling method, and this method was specifically chosen to ensure that every member of the study population is given an equal opportunity to be selected within the sample, thus minimizing the possibility of selection bias.

- ✓ **Size:** Regarding the sample size, 80 questionnaires were distributed to members of the target sample from the mentioned categories (professors and administrators). Of these, 72 questionnaires were retrieved and after the review and examination process, 4 questionnaires were excluded due to incomplete data or lack of validity for statistical analysis. Thus, the final size of the sample that was relied upon to analyze the data of this study was 68 individuals (N=68)
- ✓ **II 3. Interview sample (qualitative sample):**

- ✓ **Method of selection**: To obtain an in-depth understanding of the perspectives of the main actors directly concerned with the topic of digital transformation and digital sustainability at

the university, the interview sample was selected using the purposive method. This method relies on selecting the sample members based on specific criteria that serve the objectives of the study, such as deep knowledge of the topic or influential job position, as the interview sample included: (Vice President in charge of foresight, an official/employee in the Department of Digitization, Bir and Gars, an official/employee in the Printing and Audiovisual Center, and an official/employee in the Department of Users. Some professors at the university).

- ✓ **Rationale for selection**: These individuals were specifically selected due to their functional positions that allow them to be familiar with the strategies followed, the resources available, the digital platforms used, and the challenges facing the university in its digital path, providing rich qualitative information that supports and interprets the quantitative data
- ✓ Data collection tools:
- ✓ To collect the data needed to answer the study's questions, test its hypotheses, and achieve its objectives, a combination of quantitative and qualitative tools were used to ensure comprehensive and integrated data. These tools were:
- ✓ **1. Questionnaire:** The questionnaire is a key tool for data collection in many descriptive and survey studies, which is "a tool that includes a set of statements or questions that the respondent answers himself." A special questionnaire was designed for this study to collect quantitative data from the study sample (professors and administrators) about their perceptions of the reality of digital transformation and the level of achieving digital sustainability at the University of Ghardaia. The questionnaire was built based on the theoretical framework of the study, previous related studies, and the objectives of the current study and consisted of three main parts:
- ✓ **Part I**: Demographic and functional data: This part aimed to collect basic information about the characteristics of the sample members to be used in describing the sample and analyzing possible differences in responses and included the following variables: Gender, age group, education level, seniority (years of experience), current job, and degree of control over technology.
- ✓ **1. Second part:** Measuring the digital transformation variable: This part was dedicated to measuring the independent variable (digital transformation) from the perspective of the sample members. This axis included 15 statements distributed equally on five main dimensions (3 statements for each dimension) representing the different aspects of digital transformation in the university context: (Building the digital strategy. Human requirements.
- ✓ **2. Material requirements**. Adopted technology. Security and legislation).
- ✓ 3**. The third part: Measuring the digital sustainability variable**: This part was dedicated to measuring the dependent variable (digital sustainability) from the point of view of the sample members. This axis included 20 statements distributed on five main dimensions (4 statements for each

dimension) representing the basic indicators of digital sustainability that were identified in the theoretical framework, namely: (Innovation. Digitization. Time. Information. Speed of access.)

- ✓ A five-point Likert scale was used to measure the degree of respondents' agreement with the statements contained in the second and third parts. The following weights were given to the responses: (strongly agree = 5 degrees, agree = 4 degrees, neutral = 3 degrees, disagree = 2 degrees, strongly disagree = 1 degree)

5. Results and discussion

- It is clear from the under table that all the values of the calculated Cronbach's alpha coefficients for the dimensions and axes of the questionnaire, as well as the total value of the questionnaire, were higher than 0.700, which is recognized as the minimum acceptable value for stability in previous studies (greater than 0.9, excellent, greater than 0.8 good, greater than 0.7 acceptable, less than 0.6 questionable, greater than 0.5 poor, less than 0.5 unacceptable). Therefore, the values of the above table indicate that the study instrument enjoys a high degree of stability, making the data collected through it reliable and dependable in conducting subsequent statistical analyses.

- From the under table, we find that: The results of the Kolmogorov-Smirnova test show that the probability value (sig) of the respondents' data towards the axes of the questionnaire (study variables) is greater than (0.05):
- For the data of the respondents towards the first axis (digital transformation), we find that the probability value (0.063=SIG) is greater than the significance level of 0.05, so according to the above rule, the data of the sample towards the first axis follows a normal distribution.

- As for the respondents' data towards the second axis (digital sustainability), we find that the probability value (0.200=SIG) is greater than the significance level of 0.05, and therefore, according to the above rule, the sample data towards the second axis follows a normal distribution.

III- 1 Methods of statistical processing of the respondents' data

1. Quantitative analysis methods: The Statistical Package for the Social Sciences (SPSS) version (29) was used to analyze the quantitative data collected by the questionnaire. The following statistical methods were employed:

Frequencies (Frequencies) and Percentages (Percentages) to describe the demographic characteristics of the study sample;

b. Means (Means) to measure the central tendency of the sample members' responses to the questionnaire phrases and themes, and to determine the general level of the reality of digital transformation and digital sustainability;

c. Standard Deviations (Standard Deviations): To measure the extent to which the responses of the sample members are dispersed around their arithmetic means, which gives an indication of the degree of agreement or disagreement of the sample about the paragraphs

C. Alpha Cronbach's reliability coefficient: This is used to test the reliability of the data collection tool (questionnaire) used to measure the variables included in the study.
H. Pearson Correlation Coefficient: The correlation coefficient is used to measure the validity of the questionnaire and to measure the correlation between the variables in the study. The value of this coefficient ranges between -1 and +1, indicating the strength or weakness of the relationship between the variables. If the value is large regardless of the sign, the relationship between the two variables is strong. The sign of the coefficient indicates the direction of the relationship between the two variables. If the coefficient is positive, an increase in the value of one variable is accompanied by an increase in the other, indicating a direct relationship between them, and vice versa. The correlation coefficient value ranges can be divided into three categories: the coefficient is considered weak if its value is less than ±0.3, moderate if its value is between ±0.3 and +0.7, and strong if its value is higher than that (±0.7).

K- Regression analysis: A powerful and flexible statistical tool used to analyse the correlation between one or more dependent variables and independent variables. It is used:
To determine whether the independent variable can explain significant changes in the dependent variable: i.e. is there a relationship?
To determine the amount of variation in the dependent variable that can be explained by the independent variable: i.e., how strong is the relationship?
To determine the structure or form of the relationship: i.e., what is the mathematical equation that links the independent variable or several independent variables with the dependent variable?
To predict the value of the dependent variable.
8- Independent samples t-test: It was used to test the hypotheses of statistical differences attributable to the two response options; answer only.
9- One-way ANOVA test: It was used to test the hypotheses of statistical differences attributable to more than response options.
A level of statistical significance ($\alpha \leqslant 0.05$) was adopted as the threshold for deciding to accept or reject the null hypothesis in All applied inferential tests.
2. Qualitative analysis: The qualitative data collected through the interviews were analysed using the following method: Content Analysis Content analysis involved transcribing the interviews, then reading them in-depth to identify key ideas, recurring words and phrases, and salient themes related to the themes of the study (vision, resources, and recurring phrases and themes related to the themes of the study (vision, resources, challenges, sustainability, etc. Sustainability, etc.) The results of this analysis were used to enrich and interpret the quantitative findings from the questionnaire and provide a more in-depth understanding of the studied phenomenon
The descriptive analysis of the questionnaire data related to the first axis (digital transformation), as shown in table above reveals the reality of digital transformation at Ghardaia University. The overall arithmetic mean of the axis is (3.2480), which is falls within the intermediate level range (3.41-4.20) from the point of view of the study sample.
that the university, according to the perceptions of its professors and administration, has taken tangible steps in the path of digitisation, but it has not yet has not yet reached the stage of full digital maturity, as there are still aspects that need additional development and efforts When examining the dimensions of digital transformation separately, it is clear that there is a disparity in the levels of application, which explains The overall average level of the axis. Two dimensions received a high level of approval, reflecting relative strengths in the university's digital transformation process, while 03 dimensions received a medium level of approval, and the following is a breakdown of The strengths and weaknesses of each dimension according to their ranking in the axis:

IV-2 Analyzing the reality of digital transformation at the University of Ghardaia from the point of view of the study sample

1. The fourth dimension (technology): This dimension topped the ranking with an arithmetic mean (3.6275), which is the highest among of all the dimensions. This high level is mainly due to the sample's strong perception of the existence of a platform for distance education (mean 3.87) and the use of programmes and platforms to facilitate communication (mean 3.81).
Both achieved a high level of agreement, and although the overall perception of the university's digital progress was average (3.21), the presence of these tangible technological tools and the sample's interaction with them raises the evaluation of this dimension This is consistent with the interviews' emphasis on adopting multiple platforms (see interview responses to for (Q10).
2. The first dimension (building a digital strategy): It came in second place with a high level of agreement as well(mean 3.4118) This indicates that the respondents are convinced that the university administration has a clear vision and policy (mean 3.47) and has a recognised digital strategy (mean 3.43). and a clear policy (mean 3.47) and that it has a recognised digital strategy

(mean 3.43), where These two statements received a high level of agreement, although the clarity and measurability of the goals received a medium level (3.34).
(mean 3.34), the overall sense of strategic direction was strong, which is in line with the
with the interview findings emphasising the existence of a clear vision and strategic steps. See the answers of the Interview responses for (Q1, Q4) In contrast, the remaining three dimensions came with an average level of agreement, indicating that there are challenges or aspects that need further improvement from the sample's point of view:

1. The second dimension (human requirements): With an arithmetic mean (3.3578), this dimension falls in the average. What is notable here is the variation within the same dimension; while there is a high approval of utilizing experts and consultants (mean 3.49), approval of the adequacy of internal human resources (3.37) and incentivizing employees to adopt their ideas (3.22) were moderate. This discrepancy accurately reflects what was pointed out in the interviews
(Q5) that there is a shortage of specialized staff (see interview responses to Q5)
There is a disparity in the acceptance of training and innovation by employees, see interview responses to Q6.

2. The fifth dimension (security and legislation): This dimension also came at the average level (mean3.1078). Although there is high agreement on the existence of strict regulations against scientific plagiarism (mean 3.49), the perceptions of the sample about the extent of the security of the approved software (2.97)
(mean 3.49), the sample's perceptions about the extent of the security of approved software (2.97) and the existence of integrated control mechanisms (2.87) were moderate. This suggests some scepticism on the part of the sample about the effectiveness of the practical application of security measures, although the interviews emphasized the existence of multiple measures.
Interview responses to (Q11)

3. The third dimension (material requirements): This dimension recorded the lowest arithmetic mean (2.7353), although it is still in the it is still in the medium category, but it is the closest to the low level. All the statements in this dimension were in the
the average level, and the phrase "Availability of strong infrastructure and high-flow internet net work" was the lowest with a mean of (2.60). This strongly emphasises that the physical aspect, especially the network infrastructure network infrastructure and the availability of modern devices in the library and departments (averages of 2.81 and 2.79, respectively), represents
the most prominent weakness in the university's digital transformation system from the sample's point of view, which coincides with the challenges that were emphasised in the interviews, see interview answers for (Q7). Summary of the analysis of the first axis: It can be said that the process of digital transformation at the University of Ghardaia, as perceived by its professors and administrators, is characterized by clear strengths in terms of strategic orientation and the adoption of modern technological tools.
However, this process faces significant and medium-level challenges in the human and security aspects, and a larger and more complex challenge.
human and security aspects, and a larger and more obvious challenge in the physical aspect related to the network infrastructure and availability of devices.
and availability of devices, making the overall level of digital transformation average and requiring additional efforts, especially in enhancing material and human resources.
material and human resources. (See Appendix No:01)

V-3 Analyzing the reality of digital sustainability at the University of Ghardaia from the point of view of the study sample

The descriptive analysis of the data of the second axis (digital sustainability), as shown in the table above, shows thatThe general level of achieving digital sustainability at the University of Ghardaia,

from the point of view of the study sample, is average, as The overall arithmetic mean for the axis (3.2353) This result indicates that the concept of digital sustainability with its various dimensions (innovation, digitisation(innovation, digitisation, time, information, speed) is still in the process of crystallisation and practical application within the university and that there is a need to enhance these aspects to ensure the sustainability and effectiveness of digital resources and processes in the
As in the axis of digital transformation, analysing the dimensions of digital sustainability reveals a disparity in the levels of of their realisation:

1. The first dimension (digitisation): It is the only dimension with a high level of approval.) Mean 3.5147) This positive evaluation reflects the sample's perception of the efforts made to reduce paperwork (mean 3.75), the availability of digital space and educational platforms (mean 3.69), and the support of 3.75), the availability of digital space and educational platforms (mean 3.69), and the administration's support for digital policy (mean 3.62).
(mean 3.62), as these three statements received a high level of agreement. This is very much in line with with what was mentioned in the interviews about the adoption of multiple platforms (see interview responses to Q10) and the general trend towards digitisation. However, the statement about the availability of a website to showcase researchers' work came in at an average level (3.00).
(3.00), which may indicate that this particular aspect still needs more activation. While
The remaining four dimensions came with a moderate level of agreement, highlighting the areas that require more attention and effort to achieve digital sustainability:

The Second dimension (information): With an arithmetic mean (3.2279), this dimension is located in the middle region. The sample responses indicate an average perception of the credibility of the information circulating (3.28), the availability of a database (3.15), the ease of access to information in the library (3.38), and updating available database (3.15), easy access to information in the library (3.38), and continuous updating of the information system (3.10).
information system (3.10). This intermediate level may reflect some challenges in managing, circulating and updating digital information in a way that ensures its sustainability and accessibility, which may be partly related to to technical (poor internet) or organisational challenges.

3. The third dimension (time): This dimension also achieved an average level (mean 3.1949) with all its statements at the average level, including time management efficiency (3.01), satisfaction with scheduled times (3.24), and (3.24), and having time to focus (3.38). The negative statement (27) confirmed that there is moderate agreement (3.15), which reinforces the impression that there are challenges in time management and efficient use of time in the university environment, which is an important aspect for the sustainability of operations

4. The fifth dimension (speed of access): This dimension came at an average level (mean 3.1434), although there is a positive and high perception about the speed of issuing students' deliberations (mean 3.74), but the perceptions The sample was average with regard to the use of hardware and software that speeds up performance (3.10), and the speed of educational development
compared to other universities (2.91), and the speed of promotion in university rankings (2.82). This indicates that the concept of speed, flexibility and rapid adaptation - an important aspect of digital sustainability to keep pace with changes - still needs to be strengthened in various aspects of university work.

5. The fiveth dimension (Innovation): This dimension recorded the lowest arithmetic mean among the dimensions of digital sustainability3.0956), although it is still in the medium category. All of its statements were in the middle level. including the sample's perceptions of helping the work environment to innovate (3.32), providing innovative services(2.90), obtaining patents (3.03), and the availability of a research and development centre (3.13). This average level, especially in the tangible innovation indicators (innovative services and patents).
is fully consistent with what was mentioned in the interviews about the lack of patents and the reliance on innovative projects (see interview responses to Q8), confirming that the innovation

aspect - a key driver for the renewal and sustainability of a key driver of digital renewal and sustainability, is a clear challenge and requires greater incentivization and support.
Conclusion of the analysis of the second axis: In general, analyzing the reality of digital sustainability at the University of Ghardaïa from the point of view of the sample indicates a medium level of realization. Digitization and the use of platforms is the most positive point positive point in this axis. However, the results show that there is a clear need to strengthen other aspects related to digital sustainability, in particular: innovation and value creation, speed of access and adaptation to developments, information management and updating, and efficient utilisation. information management and updating, and efficient use of time. Achieving a higher level of digital sustainability requires addressing these intermediate aspects in parallel with ongoing digital transformation efforts. (See Appendix No:03)
-Significance of the regression model (ANOVA): The calculated F value (25.075) is statistically significant at the significance level (Sig. = 0.000), which is significantly lower than the adopted significance level (0.05). This indicates the significance of the regression model as a whole, that is, the independent variable (digital transformation) has a statistically significant explanatory power for the dependent variable (digital sustainability).
Coefficient of determination: The value of the multiple correlation coefficient (R) amounted to (0.525), which is the same value of the Pearson correlation coefficient obtained previously, and indicates the existence of a moderately strong direct correlation between the two variables. The value of the coefficient of determination (0.275) = R^2, which means that digital transformation (as an independent variable) succeeded in explaining 27.5% of the variance or change in the level of achieving digital sustainability (as a dependent variable) at Ghardaia University as perceived by its professors and administrators. The remaining 72.5% is due to other factors not included in this model (which may be other dimensions of sustainability or external factors).
o Significance of the regression coefficients: The value of the regression coefficient (β1) for the independent variable (digital transformation) is (0.432). This value is positive and indicates a positive impact of digital transformation on digital sustainability. This effect is considered statistically significant, as the calculated t value for the regression coefficient was (5.007), with a significance level (Sig. = 0.000) of less than (0.05), which means that every one unit increase in the level of digital transformation implementation leads to a statistically significant increase in the level of achieving digital sustainability by (0.432) units, with other factors remaining constant.

Summary of the impact analysis (digital transformation on digital sustainability): The results of the simple linear regression analysis confirm the existence of a positive and statistically significant effect of digital transformation on achieving digital sustainability at Ghardaia University. Digital transformation explains about 27.5% of the variance in digital sustainability. This result supports the importance of moving forward with digital transformation initiatives not only as an end in itself, but also as an effective means of enhancing the university's ability to achieve sustainability in its increasingly digital environment.

To better understand the nature of the impact relationship between digital transformation and digital sustainability, we will analyze the impact of each dimension of digital transformation (digital strategy building, human requirements, physical requirements, technology, security and legislation) on digital sustainability separately. Simple linear regression analysis will be used for each dimension to assess its independent impact on the dependent variable (digital sustainability), with the aim of identifying the dimensions that show a statistically significant effect and determining the strength of this effect for each of them.

Simple regression analysis for each dimension reveals significant results consistent with the results of the correlation analysis:
- The results confirm a positive and significant impact of four dimensions of digital transformation on digital sustainability: Physical Requirements, Technology, Human Requirements, and Digital Strategy Building (ranked in order of approximate strength of effect based on F and R^2 values.
- The physical requirements dimension is the most influential dimension in explaining the change in digital sustainability (explaining 19.6% of the variance), followed by technology (17.3%), human requirements (12.4%), and finally digital strategy building with the weakest significant effect (8.0%).

- The security and legislation dimension did not show any statistically significant impact on digital sustainability in this analysis, reinforcing the finding of no significant correlation.

These results highlight the relative importance of each dimension in driving the development of digital sustainability at the university, and emphasize the pivotal role of physical and technological infrastructure, while not overlooking the importance of the human and strategic elements, while the role of security and legislation seems to need further research and development.

6. Conclusion and Recommendations

This study presents findings based on two complementary analyses: The first is theoretical, aimed at reviewing the literature, identifying the basic concepts related to digital transformation and digital sustainability, and laying the theoretical foundation for the study; and the second is applied, through which we sought to diagnose the reality of these two variables and test the validity of the hypotheses in the field reality of the University of Ghardaia, through collecting and analyzing quantitative and qualitative data. In the following, we present the results obtained at both the theoretical and applied levels, contributing to a comprehensive understanding of the relationship between digital transformation and digital sustainability at the University of Ghardaia.

1. At the theoretical level: Through the theoretical chapters of the study, the following conclusions were reached:
Digital transformation is a comprehensive and multidimensional process that goes beyond the mere adoption of technology to include strategic, human, organizational, and cultural changes, which requires a clear vision and integrated requirements to achieve it successfully in university institutions.
Digital sustainability is a vital concept in the digital age, aiming to ensure the long-term survival, effectiveness, and evolution of digital resources and systems, taking into account innovation, security, and efficient management of information and time.
From the theoretical framework, it was concluded that there is a logical and complementary link between digital transformation and digital sustainability; as transformation initiatives create digital assets that require sustainable management, and the pursuit of digital sustainability drives further digital transformation and development.
The theoretical literature and previous studies have shown that there is a growing interest in these two concepts, but there is a need for applied studies that explore the relationship between them in specific contexts such as Algerian university institutions, which is the field aspect addressed in our study.
2. At the field level (University of Ghardaia): Through this study, we sought to translate the theoretical concepts into a tangible reality by evaluating the opinions of the study sample (professors and administrators) and the statements of officials about the level of implementation of digital transformation and achieving digital sustainability. Analyzing this data, especially after

testing the study's hypotheses, enabled us to draw a set of practical results, which we present in detail below:

Regarding the reality of digital transformation: The results show that the level of digital transformation at the University of Ghardaia is assessed as medium overall. Relative strengths stand out in the adoption of technology (especially educational and communication platforms) and the existence of a clear strategy and vision for digitization. On the other hand, there are moderate challenges in aspects related to human requirements (especially the lack of specialized competencies, resistance to change), security and legislation). Skepticism about the effectiveness of implementation). The most prominent weakness is the physical requirements, especially the weak network infrastructure (internet) and the lack of advanced hardware;

Regarding the reality of digital sustainability: The level of realization of digital sustainability is also average. The most positive dimension is "digitization" and the use of digital platforms, while the other dimensions need to be further strengthened, namely: Information (managing and updating it), time (efficient utilization), speed of access (adapting to developments), and especially innovation, which recorded the lowest level, reflecting an urgent need to stimulate digital innovation and develop internal solutions.

As for the relationship and impact: The results of our study proved that there is a moderate direct correlation and a statistically significant positive impact of digital transformation on digital sustainability. Physical requirements and technology were the two most influential dimensions in promoting digital sustainability, followed by human and strategic requirements, while security and legislation did not show a significant impact.

- Appendices:

- Appendices NO: 01

- Table (1) : **Stability coefficients (Cronbach's alpha) for the dimensions and axes of the questionnaire (N=68)**

Dimension	Number of Statements	Cronbach's alpha coefficient
Total stability of the digital transformation	15	0.765
Total stability of the digital sustainability	20	0.718
Total stability of the questionnaire	35	0.824

source : Prepared by the researchers based on the output of SPSS v29.

- Table (2) shows the results of the type of distribution

Type of distribution Data for each axis	Shapiro-Wilk			Kolmogorov-Smirnov[a]			Axes of the questionnaire
	Sig.	Df	Statistical significance of the test	(P-value)	Df	Statistical significance of the test	
Follows a normal distribution	0,080	68	0,968	0,063	68	0,104	Independent variable data
Follows a normal distribution	0,313	68	0,979	0,200*	68	0,071	Dependent variable data
the sig value is greater than 0.05, the respondents' data towards the study variables follow a normal distribution.	If the sig value is greater than 0.05, the respondents' data towards the .study variables follow a normal distribution						

Source: Prepared by the researchers based on the output of SPSS v29

- Table (3): Simple regression analysis to test the impact of digital transformation on digital sustainability

Partial statistical significance of the regression coefficients					Total statistical significance of the relationship between the two variables			
					Explanation coefficient	Correlation coefficient	Total statistical significance of the ANOVA regression model	
Statistical significance values/ P-value/)SIG(	T	B	Regression model coefficients		^{2}R R Square	R	Statistical significance values/ P-value/)SIG(	Calculated F value
0,000	6,475	1,832	B_0	Constant	0,275	0,525	0.000	25,075
0,000	5,007	0,432	B_1	Independent				

Source: Prepared by the researchers based on the output of SPSS v29

Partial statistical significance of the regression coefficients				**Significance of the overall statistic Relationship between the two variables**			
				Interpretation coefficient	**Correlation coefficient**	**ANOVA**	
/ /P-value (SIG)	**T**	**B**	Regression model coefficients	**R^2 R Square**	**R**	**P-/value (SIG)**	**Calculated F-value**
0.019	2.404	0.137	building the digital strategy	0.080	0.284	0.019	5.778
0.003	3.063	0.194	Human	0.124	0.353	0.003	9.379

			Requirements				
0.000	4.009	0.191	Physical Requirements	0.196	0.443	0.000	16.074
0.000	3.720	0.296	Technology	0.173	0.416	0.000	13.842
0.107	1.636	0.111	Security and Legislation	0.039	0.197	0.107	2.676

- Table (4): Simple regression analysis to test the impact of digital transformation dimensions on digital sustainability.

Source: Prepared by the researchers based on the output of SPSS v29

- **Appendices NO: 02**

Arithmetic means, standard deviations and level of agreement for the phrases, dimensions and axis of digital transformation

Dimension/phrase	Level	Standard Deviation (Std. Dev)	(Mean)
1.The university administration has a digital strategy	High	0.903	3.43
2.The university administration has a clear vision and policy	High	0.837	3.47
3.The university administration has clear and measurable goals, plans, and evaluation of the success of the digital strategy	Medium	0.908	3.34
Average first dimension: Building a digital strategy	**High**	**0.77720**	**3.4118**
.1 The university administration has sufficient and appropriate human cadres to deal with digital technology and modern educational technologies to bring about digital transformation	Medium	1.050	3.37
.2 Consultants and experts are utilized to provide advice on digital transformation	**High**	0.837	3.49
University management motivates its .3 employees to implement their own ideas in the field of digitization	Medium	1.091	3.22
Average of the second dimension: Human requirements	Medium	**0.68462**	**3.3578**
1. The university administration has a strong infrastructure and a high-flow internet network	Medium	1.186	2.60
2. The university library contains the latest computer technology and digital accessories to facilitate the performance of its services	Medium	1.026	2.81
3. The university departments have enough hardware (computer, printer, projector) to keep up with the digital transformation	Medium	1.204	2.79

Medium of the third dimension: Material requirements	Medium	**0.87067**	**2.7353**
1. The university administration has its own platform for distance education	**High**	0.845	3.87
2. The university administration is digitally advanced through its use of modern digital technologies	Medium	0.907	3.21
3. The university administration uses digital programs and platforms that facilitate the process of communication between the administration and students	**High**	0.675	3.81
Average fourth dimension: Technology	**High**	**0.52949**	**3.6275**
1. The university administration has strict regulations against plagiarism and violation of information privacy	**High**	0.855	3.49
2. The university administration relies on secure software with a high level of protection	Medium	0.897	2.97
3. The university administration has control mechanisms and an integrated system to control the security, privacy, quality and integrity of information	Medium	0.827	2.87
Average fifth dimension: Security and legislation	Medium	**0.66776**	**3.1078**
The first theme as a whole: Digital transformation	Medium	**0.45724**	**3.2480**

Source: Prepared by the researchers based on the output of SPSS v29

Appendices NO: 03 Arithmetic means, standard deviations and level of agreement for the phrases, dimensions and axis of digital sustainability

Dimension/phrase	Level	(Std. Dev)	(Mean)
The first dimension: Innovation			
1. The university's current work environment helps to innovate and generate new ideas	Medium	0.953	3.32
2. The university administration provides distinctive and innovative administrative services compared to other universities	Medium	0.964	2.90
3. The university administration has obtained patents that have increased its added value	Medium	0.753	3.03
4. The university has a research and development center	Medium	0.991	3.13
Average first dimension: Innovation	Medium	**0.48490**	**3.0956**
The second dimension: Digitization			
1. The university administration is witnessing a reduction in paperwork	**High**	0.952	3.75

2. The university administration has its own digital space (educational platforms)	**High**	0.885	3.69
3. The university administration supports the implementation of the digital policy	**High**	0.811	3.62
4. The university administration provides you with a website to showcase your work, research and achievements	**High**	1.065	3.00
Average of the second dimension: Digitization	**High**	**0.58889**	**3.5147**
Third dimension: Time			
5. The university administration manages its time efficiently	Medium	0.954	3.01
6. Satisfied with the times set by the university	Medium	0.994	3.24
7. I find enough time to be able to focus on my work	Medium	0.962	3.38
8. The university witnesses constant postponements of work and meetings	Medium	1.011	3.15
Average of the third dimension: Time	Medium	**0.57764**	**3.1949**
Fourth dimension: Information			
1. The information circulating in the university is credible	Medium	0.990	3.28
2. The university has a database available to all units and departments	Medium	0.950	3.15
3. There is easy access to information in the library at any time	Medium	0.962	3.38
4. The university continuously modernizes the information system used to ensure modern digital sustainability	Medium	1.067	3.10
Average of the fourth dimension: Information	Medium	**0.65039**	**3.2279**
Fifth dimension: Access speed			
5. The university administration is characterized by the speed of issuing deliberations to students	**High**	0.891	3.74
6. The university administration uses digital devices and programs that provide speed in performing tasks	Medium	0.900	3.10
7. The university is characterized by	Medium	0.910	2.91

the speed of educational development compared to other universities			
8. The university is experiencing speed in upgrading in the ranking of the best universities in Algeria	Medium	0.961	2.82
Average fifth dimension: Accessibility	Medium	**0.64403**	**3.1434**
The second axis as a whole: Digital sustainability	Medium	**0.37646**	**3.2353**

Source: Prepared by the researchers based on the output of SPSS v29

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