

Digital Bureaucracy? Transformations of Leadership and Administrative Practices in Algerian Public Institutions. - A Case Study-

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Receipt date : 26/10/2025 ; Acceptance Date: 28/11/2025

Abstract: This study explores the relationship between digital bureaucracy and administrative leadership within the Algerian context, aiming to critically examine how traditional leadership paradigms are being reshaped toward greater transparency, participation, and innovation. Employing a descriptive-analytical approach alongside a mixed-methods design, the research integrates quantitative data (collected through Likert-scale questionnaires administered to a sample of 35 employees at the Omar Municipality in the Wilaya of Touggourt) with qualitative insights (gathered through interviews and observational techniques). The findings indicate a moderate acceptance of digitalization as a means to enhance communication and decision-making processes. However, they also expose a marked dissonance between official digital discourse and entrenched traditional bureaucratic structures, which often resist both cultural and organizational transformation. The study underscores the urgent need for strong leadership commitment, comprehensive digital skills training, and the cultivation of a supportive organizational culture to effectively integrate technological innovations with social dynamics, ultimately aiming to restore and strengthen public trust in administrative institutions.

Keywords: Administrative Leadership; Digital Bureaucracy; Digital Transformation; Organizational Culture; Information Technology.

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1 - Introduction

The digital transformations currently reshaping contemporary administrative systems have fostered a profound interaction between technology and the social structure, leading to the reconfiguration of organizational relationships and institutional behaviors. This transformation transcends the mere technical function of machines, becoming a decisive factor in the redistribution of power and knowledge within administrative spaces. In the context of digital globalization, digitalization is no longer merely a tool for enhancing human resource efficiency within institutions, but rather a cornerstone in the renewal of traditional bureaucratic structures. This shift has given rise to a new form of "digital bureaucracy" that redefines concepts of leadership and authority within institutions by integrating analytical tools and interactive networks into decision-making and resource management processes. This transformation, which constitutes a modernist revolution in the nature of administrative work, faces deep structural challenges in many developing countries, particularly those grappling with the entrenched legacy of centralized bureaucracy that dominates various administrative practices, coupled with a prevailing organizational culture resistant to change, as is the case in Algerian public institutions.

In this context, digitalization emerges as a socio-technical project that embodies contradictions between digital modernity and the traditional structures prevailing within institutions. Since 2022, the Algerian state has sought to invest in strategies for digitally modernizing its administrative institutions through the adoption of digital platforms aimed at streamlining procedures and promoting transparency. However, these efforts are now encountering tacit resistance from administrative actors whose entrenched work habits—embedded within the organizational culture—are rooted in centralization and control. Algerian public administration institutions, which serve as incubators of complex social relationships, are currently witnessing a latent conflict between the official "digital discourse" and a structurally entrenched reality steeped in the values of classical traditional bureaucracy. This discord complicates the role of leadership in adopting participatory leadership models aligned with contemporary demands. The challenge, therefore, is not merely technical but extends to the sociological reconfiguration of the relationship between the employee, the citizen, the institution, and society at large. It calls for the integration of technology as a means to build digital social capital that reinforces trust and encourages participation.

Hence, it is imperative to understand and analyze the re-articulation of administrative leadership principles and concepts within the framework of digitalization—not as a purely technical issue, but as a process of social re-engineering that requires a deep understanding of cultural dynamics and organizational behaviors. This leads to the central question of the study: How can the digital transformation experienced by public administrative institutions in Algeria contribute to the redefinition of traditional leadership concepts? And how can administrative leadership, in the context of digitalization, overcome the barriers associated with resistance to change and cultural adaptation within public institutions, particularly those operating in specific urban and cultural environments such as Southern Algeria? Can leadership become an effective "techno-sociological intermediary" capable of transforming the bureaucratic mindset of these institutions? Moreover, are Algerian public institutions, especially municipalities, capable of converting technology into a tool for fostering positive leadership practices and enhancing internal resilience?

These methodological issues form the core of the present research, which aims to analyze the dialectical interaction between socio-technological variables (such as organizational and structural culture) and leadership practices in the context of digital

transformation. This will be achieved through a case study focused on the administrative district as a symbolic space where the conflict between the old and the new is most vividly manifested, based on the central research question:

- How does digital bureaucracy reshape leadership practices and organizational structures within public institutions?
- From this central question, the following sub-questions emerge:
- How does digital bureaucracy contribute to the redefinition of traditional leadership concepts in public administration?
 - How does the implementation of digital bureaucracy activate positive leadership practices (communication, decision-making, performance management, employee motivation) within public administration?
 - What functional and organizational challenges do leaders in public administration face in the context of digital bureaucracy?

1.1- Research Hypotheses:

This study proceeds from a general hypothesis that posits:

- Administrative leadership interacts positively with the processes of digital bureaucracy within Algerian public institutions. From this general hypothesis, three sub-hypotheses are derived, each aiming to test core dimensions of the study's central problem:
- Digital bureaucracy in public administration contributes to the redefinition of traditional administrative leadership concepts toward principles of transparency, participation, and innovation.
- The implementation of digital bureaucracy enhances administrative leadership practices by strengthening communication, decision-making, and performance efficiency within public administration.

1.2- Temporal and Spatial Scope of the Study:

The study focuses on the municipality of Belidet Omar in the Wilaya of Tougourt as a model case study, given its status as a local administrative unit that reflects the challenges and characteristics of Algerian public institutions undergoing digital transformation in desert regions.

...where it faces dual challenges combining geographical constraints and a lack of digital infrastructure, offering an opportunity to analyze leadership interaction with digitalization in resource-limited contexts. The study was conducted during the period from January to June 2025, and its results reflect the administrative reality during this timeframe, bearing in mind that future developments may affect leadership dynamics or the adoption of digitalization.

The study's human field included municipal employees through a purposive sample, with 35 employees out of 70 participating, selected based on specific characteristics. The choice of the municipality of Belidet Omar as the spatial field strengthens the study's objectives of understanding how leadership interacts with digitalization in small institutions and remote areas. It also serves as an opportunity to observe the effects of recent government policies related to digitalization, such as the "e-government" projects launched by the Algerian state. The study highlights the varying perceptions among employees regarding digital transformation, particularly the differences in acceptance levels between higher-level administrative staff (more attuned to political directives) and operational employees (who experience practical difficulties in implementation).

1.3- Operational Definitions of Key Concepts:

To ensure conceptual precision and contextual relevance, the core terms of this study are defined operationally as follows:

- **Administrative Leadership:** This refers to the process of making precise strategic decisions, efficiently coordinating resources, and fostering collaboration within complex, multidimensional work environments, whether in the public or private sector. It is considered a fundamental pillar in managing modern organizational activities, with its function rooted in linking employees to institutional plans and future visions, and in integrating ideas within a collaborative working environment (Jamal Daldoul, 2016, p. 248). It is measured by analyzing sample responses concerning core administrative functions (planning, organizing, directing, and decision-making) within the institution. The questionnaire items were designed to assess these dimensions accurately.
- **Digital Bureaucracy:** This denotes the systematic integration of digital technologies into administrative and organizational processes within government institutions and public organizations, aiming to enhance operational efficiency, achieve transparency, and facilitate interaction with citizens and stakeholders. This practice involves the application of advanced technological tools such as digital applications and automated data processing systems to support decision-making and improve administrative operations (Shovkovyy Oleg, 2024, p. 04). It is measured by the degree to which digital tools and technological applications are utilized in carrying out the institution's administrative and service tasks.
- **Administration:** Defined as a multidimensional process (dynamic, complex, flexible, and rational) aimed at setting and achieving objectives through effective coordination of human, technical, and financial resources within changing environmental contexts that interact with the organization. This process requires the precise integration of institutional mission, vision, strategy, and cultural values to ensure organizational empowerment and to achieve present and future goals, while accounting for external constraints (social, economic, and environmental) that pose challenges to its success (IDOWU Samuel O, et al., 2013, p. 1609).
- **Municipal Public Institution:** It is the basic administrative unit within Algeria's organizational system and represents the foundational territorial community of the state, as defined by Algerian constitutions and Law No. 11-10 of 2011, which regulates municipalities. It enjoys independent legal personality and partial financial autonomy, and is managed by democratically elected local representative bodies in accordance with the principles and procedures stipulated by the aforementioned legislation (Boukouro Manal & Mohamed Mansouri, 2018, p. 227). These local bodies serve as executive instruments for implementing local development policies and serving the public interest within a framework of administrative decentralization and fiscal delegation

1.4- Previous Studies on the Topic:

Previous studies on digital bureaucracy constitute a broad field combining theoretical analysis with field applications. These studies have shown that digital bureaucracy reshapes organizational and social relationships within public institutions. The following is a review of some relevant contributions:

These studies suggest that digital bureaucracy is characterized by its interaction with technologies such as algorithms and electronic platforms, reshaping traditional bureaucratic processes into digital formats. Although such tools were expected to reduce the shortcomings of classical bureaucracy, they often reproduce bureaucratic traits in new

forms—such as hierarchical structures and complex procedures—but within digital environments. For example, the digitization of administrative processes has led to the emergence of the term "e-bureaucracy," which replicates organizational complexities through digital interfaces, such as difficulties in navigating online forms, system failures, and user alienation due to impersonal interactions (Shovkovyy, 2024).

On the other hand, digital bureaucracy has contributed to increased efficiency and transparency through the use of information and communication technologies. In Indonesia, e-government systems and mobile applications have expedited administrative procedures and improved interaction between governments and communities (Sopamena, 2024). These advancements have supported principles of good governance, such as accountability and inclusiveness, by providing digital tools for performance monitoring and service evaluation (Seta et al., 2024).

The integration of digital technologies has redefined the nature of administrative work, as manual tasks have become automated or semi-automated, increasing efficiency and reducing costs. In Germany, the digitization of tax declarations and vehicle registrations simplified procedures, allowing public employees to focus on more complex tasks (Gräfe et al., 2024). In Indonesia, e-government systems improved transparency and reduced corruption through automated process monitoring (Setyawan, 2024). However, the digital transformation has introduced new challenges, such as "invisible work," which includes data validation and software maintenance—crucial tasks that are often overlooked despite their importance to digital systems (Gräfe et al., 2024). Additionally, the digitization of procedures has spotlighted issues of digital inequality, as not all citizens enjoy equal access to digital services, potentially leading to indirect discrimination.

Effective leadership has proven to be a critical factor in adopting digital bureaucracy. Institutions require leaders capable of guiding digital transformation and addressing resistance to change. In South Korea, strategic leadership contributed to the development of e-government, placing the country at the top of global rankings (Sadykova & Galy, 2024). In Indonesia, leadership commitment to developing digital infrastructure facilitated the implementation of digital initiatives (Afrilia et al., 2024). Organizational culture also plays a pivotal role in adopting digital tools. In India, bureaucratic resistance and digital illiteracy among employees hindered the implementation of e-government projects, underscoring the importance of fostering a culture of innovation and continuous learning (Dhandar, 2024). Therefore, to realize the potential of digital bureaucracy, public institutions must address challenges related to digital infrastructure, employee digital literacy, and the alignment of modern technologies with local needs (Kalinichenko, 2024). Developing a national digital strategy and improved legislative frameworks is also necessary to enhance digital governance (Hernawan & Wijaya, 2024).

In summary, the aforementioned studies contribute to understanding digital transformation in public institutions, but they often focus on Western or Asian contexts and overlook the sociological and cultural complexities of developing countries. For instance, they show that digitalization does not eliminate traditional bureaucracy but reproduces it in digital forms. However, they do not address how this phenomenon interacts with bureaucratic legacies and organizational culture in settings lacking digital infrastructure or technical skills. While they highlight the role of strategic leadership in successful digitalization, they often neglect the contradictions between official digital discourse and the structural realities of institutions facing strong cultural resistance and centralization.

Here lies the epistemological value of our study, which offers a deep sociological analysis of digital bureaucracy in the Algerian context. Focusing on the municipality of Belidet Omar in the Wilaya of Touggourt as a case study, it seeks to bridge the gap between technology and social structure through an analytical framework that integrates theories of organizational sociology. The study aims to explain how digitalization interacts with administrative leadership and human structures using a mixed-methods approach that combines quantitative data (such as questionnaires) with qualitative methods (semi-structured interviews and scientific observation). This approach enhances understanding of administrative phenomena while taking into account the geographic and cultural characteristics of Algerian institutions.

1.5- Theoretical Approaches to the Study:

Academic tradition in the sciences—particularly in the social sciences—requires researchers to approach social phenomena under investigation through theoretical frameworks specific to their disciplines. These frameworks provide the tools necessary for sociological analysis, enabling a deeper understanding of the phenomenon and its relationship to its environment. Accordingly, in this study, we explored the issue of digital bureaucracy in its relation to administrative leadership through several theoretical approaches within the sociology of organizations, as follows:

- **Bureaucratic Organization Theory:** One of the foundational theories in the sociology of administration, it aims to achieve efficiency and organization in institutions through a clear structure based on rules and formal procedures (Weber, 1947). It represents an administrative model designed to systematically manage large organizations away from personal relationships or arbitrary decisions. The theory rests on key principles such as precise division of labor based on skills and expertise to enhance productivity and reduce overlapping responsibilities; structuring the organization hierarchically with clearly defined roles and authority, with decision-making and supervision flowing through formal lines; establishing written policies and procedures to govern administrative operations, ensuring transparency and fairness; decision-making based on rules rather than personal relationships or emotions to maintain objectivity; reliance on official records and documents to manage operations and provide accurate historical tracking of decisions and activities; and recruitment based on academic qualifications and skills, rather than social affiliations or personal connections.

In the digital age, classical bureaucracy has evolved into digital bureaucracy, integrating technology into administrative processes to accelerate procedures and enhance transparency, while maintaining Weber's core principles such as specialization and hierarchical structure (Dunleavy et al., 2006, p. 488). Nonetheless, challenges related to flexibility and creativity persist, necessitating a reconsideration of how bureaucratic principles are applied in modern contexts.

- **Organizational Change Theory:** It is considered one of the important theories in the sociology of management, as it focuses on the ability of leaders to inspire and motivate employees to achieve organizational goals that go beyond individual interests, by emphasizing radical change in organizational culture and future vision rather than daily supervision or material rewards. Transformational leadership is divided into four main components according to the Bass model (Bass & Riggio, 2006): the leader's role model for employees through ethical behaviors and commitment to values, which enhances trust and loyalty; providing a clear and shared vision; motivating employees through positive and ambitious discourse that inspires

them to work diligently; encouraging creativity and critical thinking and motivating employees to question and innovate rather than adhere mechanically to procedures; in addition to supporting the individual growth of employees by listening to their needs and providing guidance and personalized feedback.

In the context of digital transformation, transformational leadership has evolved to include the use of technology to enhance communication and participation, such as virtual collaboration platforms and data analysis to support decision-making, as well as remote management by motivating geographically distributed teams through digital tools while maintaining a collective spirit.

2- Method and Tools:

The practice of scientific research within the fields of social sciences, especially sociology, requires the researcher to strictly adhere to the methodology of such research, which in turn leads to a set of techniques, methods, and tools to investigate and inquire about the subject of scientific curiosity. Therefore, in this study, we tried to trace aspects of digital bureaucracy embodied by public administrations and the interaction of administrative leadership with it, according to the following elements:

2.5- Study Method, Sample, and Tools Used:

The study relied on the descriptive-analytical method as the most suitable for understanding social and administrative phenomena in their natural context, as this method allows describing reality as it is and analyzing the complex relationships between its variables, revealing underlying patterns. It was chosen because it aligns with the research goals of exploring the transformations of administrative leadership within digital bureaucracy, linking theoretical aspects with practical applications and determining the extent to which leaders interact with traditional and cultural bureaucratic challenges within the institution.

To collect data, a questionnaire was designed and directed to a sample of employees from the municipality of Balidet Omar in the Wilaya of Touggourt. The sample size was determined based on methodological (purposive sampling) and practical considerations. The data collection process faced logistical challenges such as the unavailability of some employees during the research period due to tasks outside the institution or frequent absences for health and administrative reasons, as well as variability in work schedules affecting access to all sample members. To ensure accuracy and reliability in data collection, the researcher focused on available employees who met participation criteria, using flexible mechanisms to adapt to field conditions.

These procedures were consistent with the limited nature of the study population and the exploratory nature of the study. The number of participants was 35 employees (i.e., a response rate of 50%), a sufficient size in descriptive studies focusing on analytical depth and specific institutional context. The margin of error was calculated at $\pm 11\%$ with a 95% confidence level assuming a normal distribution, which is acceptable in behavioral research within closed organizational environments. The sample covered a balanced representation of administrative departments and key job ranks within the municipality, enhancing its internal validity. These data were complemented by semi-structured interviews to deepen the study results.

The questionnaire included questions covering three main axes:

- **Employee perception of digital transformation:** to assess their acceptance of technology concepts and its impact on administrative processes.

- **Prevalent leadership style:** to analyze the flexibility or centralization of leadership practices and their interaction with digital tools.
- **Structural and cultural challenges:** to identify obstacles leaders face in adopting digitalization (e.g., resistance to change, weak technical qualification, and misalignment of organizational structures).

The data underwent descriptive statistical analysis (e.g., percentages, means, measures of central tendency and dispersion) using the statistical program JASP, which helped extract objective results reflecting the institution's reality. This method contributed to achieving the study's goal of evaluating leaders' efficiency in using digital tools, diagnosing shifts in traditional leadership styles, and identifying structural and cultural obstacles hindering digital transformation.

Study Tools: The study relied on the questionnaire as the main tool for collecting quantitative data, given its ability to provide accurate information from a large number of respondents in a short time efficiently and cost-effectively. The questionnaire was designed in two main parts to accurately and comprehensively achieve the research objectives:

- **Part One:** dedicated to collecting participants' demographic data, such as gender, age, education level, job position, and years of experience. These data aimed to identify the psychometric characteristics of the sample, enabling analysis of how personal factors (e.g., experience or educational level) influence employees' perceptions of digital transformation and leadership styles.
- **Part Two:** focused on analyzing the main research topics and included three axes: the reality of administrative leadership in the institution; the use of digital tools (such as electronic platforms, data analysis) in administrative processes; the impact of digitalization on leadership effectiveness in terms of decision-making, motivation, and performance monitoring. This part was designed using the five-point Likert scale (from 1 = "Strongly Disagree" to 5 = "Strongly Agree"), allowing for accurate measurement and statistical analysis of respondents' opinions to extract objective results.

To enhance the credibility of the results, the quantitative data was supplemented with field scientific observations and semi-structured interviews with the institution's leaders and employees. This ensured methodological triangulation and a deeper understanding of the studied phenomena. The researcher observed administrative processes at the municipality of Balidet Omar, such as local council meetings, communication mechanisms between leaders and employees, and implementation of digital projects. These observations helped document actual behaviors of leaders and their interaction with digital tools beyond subjective impressions. Research interviews were conducted with several employees (from different administrative levels, including department heads and digital project managers) using a list of open-ended questions focusing on challenges of leadership adoption of digitalization, the impact of organizational culture on technology acceptance, and experiences of success or failure in applying digital tools. These interviews revealed deep-rooted structural issues (e.g., resistance to change or weak qualification), which cannot be inferred from questionnaires alone.

2.2- Validity and Reliability of the Questionnaire:

As for the statistical coefficients of Cronbach's Alpha and Pearson's correlation, they were used to assess the instrument's validity and reliability, and they yielded the following results:

- **First:** To ensure measurement validity, Pearson correlation coefficients were calculated between the scores of each item in the three axes and the total score of the axis it belongs to. Results showed correlation coefficients in the first axis (formulation of traditional leadership concepts) between 0.68 and 0.75, indicating a strong positive correlation between individual items and the axis as a whole. The second axis (technology application) showed coefficients between 0.61 and 0.73, reinforcing the instrument's validity. The third axis (organizational and functional obstacles) showed correlations between 0.73 and 0.81, proving the items effectively reflect their theoretical content.

Table (1): Comparison between Pearson and Spearman correlation coefficients

Coefficient	First Axis	Second Axis	Third Axis
Spearman (ρ)	0.65–0.74	0.48–0.70	0.70–0.81
Pearson (r)	0.68–0.75	0.58–0.73	0.73–0.81

Source: Prepared by the researcher based on the questionnaire data and JASP output.

The table shows slight differences in results, confirming result consistency despite differing calculation methodologies. Spearman's coefficient shows more conservative values due to the use of ranks.

- **Second:** To ensure measurement reliability, internal consistency of the instrument was measured using Cronbach's Alpha for each axis and total score. Results were as follows:

Table (2): Cronbach's Alpha reliability coefficient for questionnaire axes

Dimension	Items	Cronbach's Alpha	Reliability Level
Traditional leadership concepts	01 to 06	0.89	Excellent
Technology application	01 to 07	0.85	Very Good
Organizational and functional barriers	01 to 08	0.91	Excellent

Source: Prepared by the researcher based on the questionnaire data and JASP output.

Thus, the table values confirm that the tool enjoys excellent reliability across all axes. Therefore, the psychometric results of the study tool (questionnaire) show high validity and reliability, allowing its use in analyzing the study's dimensions. However, researchers must be cautious when generalizing results due to the specificity of the Algerian desert context, which may influence the interactions between technology and administrative practices.

2.3- Psychometric Characteristics of the Study Sample:

Table (3): Psychometric characteristics of respondents

Variable/ Gender	Frequency	Percentage
Male	23	65.71%
Female	12	34.28%
Age	Percentage	Percentage
30–40 years	15	42.85%
Over 40 years	20	57.14%
Years of Experience	Percentage	Percentage
Less than 5 years	5	14.28%
5–10 years	11	31.42%

Variable/ Gender	Frequency	Percentage
11–15 years	9	25.71%
Over 15 years	10	28.
Total:	35	100%

• **Educational Level**

Alternative	Frequency	Percentage
Secondary	15	42.85%
University	13	37.14%
Postgraduate	1	02.85%
Applied Studies	6	17.14%
Total:	35	100%

Job Position	Frequency	Percentage
Department Head	07	20%
Administrative Clerk	21	60%
Technical Assistant	07	20%
Total:	35	100%

Source: Researcher based on JASP statistical program

The distribution of the previous table reflects the social and cultural structure of the desert region, where women's participation in administrative positions is relatively limited due to social or cultural barriers. The dominance of males may reinforce traditional leadership models (centralized, hierarchical), complicating the shift towards shared digital leadership models. The results also point to the predominance of older generations, who may be less flexible in adopting digital technologies compared to younger generations. Older generations often have entrenched traditional work habits, which exacerbates resistance to change within the institution. The sample also shows a significant accumulation of traditional experience, as most employees have more than 5 years of experience. While this may contribute to work stability, it poses a challenge in adopting digital tools and overcoming resistance to change.

The table also indicates a relative shortage of advanced technical competencies, as most employees have not exceeded the secondary or general university level. This reality limits the institution's ability to effectively leverage digital tools, especially in areas like data analysis or smart platforms. It is also noticeable that executive roles (administrative clerks) dominate, indicating weak representation of leadership and technical roles in the sample. This reality may hinder the institution's move towards flexible digital leadership models, as decision-makers (department heads) represent only a small portion of the sample.

3- Results and Discussion

3.3- Presentation and Discussion of Study Results for the First Axis:

Table (4): Arithmetic Means and Standard Deviations of the Sample's Estimates Regarding the Impact of Digital Transformation on Traditional Leadership Concepts

Digital Leadership Concepts	Frequency	Percentage	Mean	Sta. Dev	Rank
The implementation of digitization contributed to positively changing the leadership style within the institution.	18	51.71%	4.20	0.83	Agree
The need to rely on personal experience in decision-making has declined in favor of digital data within the institution.	18	51.71%	3.51	1.01	Agree
Digitization has helped enhance the principle of transparency in managing the institution.	32	91.01%	4.28	0.89	Agree
New management concepts based on participation and empowerment have emerged as a result of digitization.	22	62.85%	4.02	0.89	Agree
Today's leadership style in management relies more on innovation and renewal thanks to digitization.	26	74.28%	4.14	0.49	Agree
Leadership style in management has become less centralized and more flexible thanks to digital transformation.	30	85.42%	4.11	0.83	Agree

Source: Prepared by the researcher based on the JASP program

From observing the previous table, the following results can be deduced:

The results related to the **first item**, which came with an arithmetic mean of 4.20 and a standard deviation of 0.83, indicate a general positive perception of the impact of digitization on updating leadership practices, with partial reservation reflecting resistance from the older, experienced generation. This suggests partial acceptance of digitization's influence on leadership style. This may be explained by a positive perception among half of the employees that digitization has improved leadership style. Therefore, this percentage does not reflect a full or deep transformation in the nature of leadership, which can be explained through the psychometric characteristics of the sample. Employees over forty years old possess a traditional legacy that values experience, making them partially accept digital change without fully abandoning the traditional "professional sense." Moreover, the study community was characterized by weak representation of leadership roles and a majority of employees with long experience (over 5 years) and an average educational level (secondary or general university). These factors negatively affect the understanding of digital transformations in leadership.

This is what was pointed out by (Dhandar, 2024), who found that digital bureaucracy can enhance efficiency and transparency; however, weak technical competencies among employees hinder the adoption of digital tools. Similarly, the study by (Dunleavy et al., 2006) showed that change might rely more on formal directives than on personal initiative, reflecting a "formal" digital bureaucracy that reproduces hierarchical structures. This reality can also be interpreted through bureaucratic organization theory, where digitization did not eliminate traditional bureaucratic structures but rather reorganized them formally. Resistance to change can also be understood through organizational change theory, especially in institutions with entrenched cultures that reinforce adherence to traditional models. Therefore, the institution may have partially succeeded in the "unfreezing" stage mentioned by Kurt Lewin, where employees began to perceive the benefits of this change. From the perspective of transformational leadership theory, this

may indicate that leaders have started adopting transformational behaviors, such as using technology to improve communication, which positively affected employee perceptions.

Regarding the **second item**, which had an arithmetic mean of 3.51, it shows a shift toward digital rationality with cautious acceptance of this concept, with a high standard deviation of 1.01, reflecting variation in respondents' experiences. Therefore, these values indicate divided opinions, which is expected in an institution undergoing transformation. However, overall results show that most respondents believe the need for personal experience in decision-making has not fully diminished despite the emergence of digital tools. This reflects weak confidence in the technical competence of data analysis tools among a sample mostly holding lower educational levels (secondary certificates), signaling weak digital skills, making the use of digital data unfamiliar or difficult. Also, the dominance of older males reinforces traditional charismatic leadership models, as most of the sample has over 5 years of experience. This significant accumulation of traditional experience makes it difficult to abandon usual decision-making patterns, according to bureaucracy theory.

This challenge reflects what was mentioned in the study by (Gräfe et al., 2024) regarding task transformation, where digital transformation allows employees to focus on complex tasks but requires trust in digital data. Digital data may be insufficient in a context lacking infrastructure (like a desert municipality), increasing hidden reliance on employees' experience to correct system errors. In this context, the study by (Seta et al., 2024) confirmed that data-based decision-making requires digital infrastructure and analytical skills, which are relatively absent in the sample. Theoretically, this result conflicts with transformational leadership theory, which encourages critical thinking and data usage, but aligns with organizational change theory that suggests experienced employees resist changes that threaten their traditional practices. This contradiction is consistent with bureaucratic organization theory principles, advocating rule-based governance and official records, where implementation was limited due to technical and cultural gaps among older generations.

The **third item** achieved the highest mean of 4.28 with a standard deviation of 0.89, indicating broad recognition that digitization contributed to improving transparency. This reflects a tangible success for digital platforms in reducing human interventions, tracking performance, reporting results, and minimizing corruption or discrimination. This strong result transcends the demographic characteristics of the sample (age, gender, experience) and can be explained by the fact that the transparency resulting from these measures is a direct benefit easily noticed by everyone, regardless of their digital skills or openness to change. This result supports African and Asian studies, as indicated in (Setyawan, 2024), regarding the role of e-government in enhancing accountability and organizational justice while reducing corruption through automated monitoring.

Theoretically, this item supports bureaucratic organization theory, which emphasizes the importance of clear, transparent rules for managing operations within a written system of policies and official records to ensure transparency and fairness. Digitization here does not eliminate this principle but reinforces it, making it more effective through automated documentation of decisions and activities. It also aligns with transformational leadership theory, which focuses on ethical values and motivation through transparency as a cornerstone for building trust and innovation within teams.

Regarding the **fourth item**, which recorded a mean score of 4.02 with a standard deviation of 0.89, these values indicate a relative acceptance of the concepts of shared and participatory leadership, signaling the beginning of a cultural transformation within the institution. However, this is less than expected when compared to the result on

transparency. This can be interpreted by the fact that the sample is dominated by employees in executive roles (administrative assistants), who may not directly perceive an increase in empowerment compared to managers. This reflects a weak representation of leadership and technical roles, which limits the institution's capacity to delegate authority, distribute roles, and activate participatory leadership concepts.

In this context, the result highlights the contradiction referred to in the study's introduction between the "official digital discourse" and the "structural reality." Participation and empowerment may be discussed, but the traditional hierarchical structures—reinforced by the sample's demographic composition—may resist such change in practice. The study by Sadykova & Galy (2024) emphasized that strategic leadership is a prerequisite for adopting digital tools, which seems to be relatively lacking here. This intersects with Lewin's model, which stresses the need to first "unfreeze" cultural inertia and then "refreeze" through training and building a supportive culture so that new empowerment practices become stable. In a desert context marked by strong bureaucratic traditions (such as Touggourt province), traditional relationships may be reproduced through digital tools. Theoretically, this item aligns with transformational leadership theory, which encourages empowerment and participation, but it requires stronger leadership support. Organizational change theory also suggests that the change process has begun but has not yet deepened, as evidenced by efforts to reduce hierarchical structures and focus on teamwork. However, the implicit resistance observed in a third of the sample reflects the difficulty of applying these theories in a traditional organizational environment.

Regarding the **fifth item**, it recorded a mean score of 4.14 with a low standard deviation of 0.49, which indicates a high and positive acceptance among respondents of the idea that digitalization has enhanced innovation. This approval reflects a positive impact of digitalization on accelerating processes within the institution. However, this strong approval seems contradictory given the characteristics of the sample, which lacks advanced technical competencies (majority have secondary or general university education) and is dominated by older generations. This may suggest that employees interpret "innovation and renewal" as the mere use of digital tools instead of paper-based methods, rather than strategic innovation in processes. In this regard, (Gräfe et al. 2024) noted that digitalization simplified procedures but also created "invisible work" that has not yet been fully appreciated. Similarly, (Kalinichenko 2024) indicated that older employees tend to be less flexible in adopting innovation, which may create a gap between official discourse and daily practice.

Theoretically, this item aligns with a key component of transformational leadership theory, which is the encouragement of creativity and critical thinking, where leaders encourage employees to question and innovate. However, further development is needed given the weakness of technical competencies. Organizational change theory also indicates that this is the beginning of a transformation, which still requires stronger support, and should not rely solely on superficial application of new tools by the institution.

The **sixth item** shows a mean score of 4.11 with a standard deviation of 0.83, indicating a clear perception among respondents of a change in the nature of authority within the institution. This result is particularly surprising given the social structure of the sample, which is majority male, older generations, and long-term experience—factors that typically reinforce centralized and hierarchical leadership models. Therefore, this high level of agreement may reflect one of two possibilities: either digitalization has indeed enforced flexibility in information flow and daily task management, giving

employees a greater sense of autonomy in performing their duties, or there is a gap between perception and reality, where the perceived flexibility is superficial and limited to minor tasks, facilitated by digital tools that make communication and information sharing easier, rather than an actual restructuring of authority. Strategic decisions and the overall institutional structure may still remain centralized, especially in institutions with a strong bureaucratic legacy (like Algerian municipalities), where flexibility is reformulated through digital channels without dismantling hierarchical structures. This is the same conclusion reached by Dhandar (2024) in the case of India.

Theoretically, this item shows how digitalization has begun to mitigate some of the rigid traits of classical bureaucracy, but it has not eliminated the principle of hierarchical structure, as indicated by bureaucratic organization theory. This trend is supported by transformational leadership theory, which focuses on encouraging innovation and participation, but it still requires strengthening digital infrastructure and raising employee skill levels. It also aligns with agile organizational change approaches, which recommend reducing hierarchical structures and enhancing self-organizing teams, necessitating strategic leadership capable of facilitating transformation in traditional bureaucratic environments).

3.2- Presentation and Discussion of the Second Axis Results:

Table (5): Shows the means and standard deviations of the sample categories' estimates on the **application of digital technology in activating leadership practices.**

Activating Leadership Practices	Frequency	Percentage	Mean	Std. Dev.	Rank
Digitalization has provided effective means of communication between supervisors and employees.	31	88.42	4.20	0.79	Agree
Using digital tools helped improve the quality of decision-making within the institution.	21	60.00	4.14	0.69	Agree
The application of digitalization facilitated monitoring and evaluating employee performance.	28	79.85	4.08	0.79	Agree
Digitalization enhanced leaders' ability to provide moral and material motivation to employees.	22	62.85	3.88	0.79	Agree
Supervisors were able to organize work and distribute tasks more efficiently using digital applications.	18	51.42	3.97	0.82	Agree
The application of digitalization improved the handling of employee complaints and feedback by the administration.	19	54.28	4.02	0.74	Agree
The application of digitalization led to improved responsiveness to changes in the work environment.	17	48.57	4.08	0.91	Agree

Activating Leadership Practices	Frequency	Percentage	Mean	Std. Dev.	Rank
Digitalization reduced the burden of daily bureaucratic tasks in the institution.	28	79.85	4.11	0.90	Agree

Source: Prepared by the researcher based on the JASP statistical program

The general observation from the results of this table is that the application of digital technology in the municipality of "Omar" in Touggourt Province reflects a complex interaction between digital tools, the sociocultural characteristics of the sample, and the existing bureaucratic structures. The results show a general agreement among respondents on the positive impact of digitalization, but also reveal deep contradictions when analyzed through theoretical frameworks and demographic characteristics, as outlined below:

The **first item**, with a high mean score of 4.20 and a low standard deviation of 0.79, indicates that the statement received near-unanimous approval from respondents. This reflects a broad awareness that digital media (email, collaborative platforms) have broken traditional communication barriers within the institution. This is expected from the study sample, as the most readily perceived benefit of digitalization is improved communication infrastructure. Even though they may prefer traditional methods, the high approval suggests a gradual adaptation to technology. The advantage of digital communication channels lies in ease of use and in overcoming spatial, temporal, and cultural barriers in the desert environment, which had previously reinforced traditional hierarchical structures. This result stems from the sample's characteristics, mainly male dominance and accumulated traditional experience, which allowed respondents to observe the effects of these tools in accelerating information exchange and reducing administrative delays. This aligns with the e-government model in studies by Sopamena (2024) and Seta et al. (2024), which emphasized the importance of digital technology in enhancing transparency and communication within public institutions, thus improving interaction between government entities and communities.

This result directly supports the digital aspect of transformational leadership theory, which stresses the use of technology to enhance communication and participation. A transformational leader uses these tools to convey their vision and motivate employees more effectively. From the perspective of bureaucratic organization theory, the introduction of digital tools into communication reshapes traditional organizational structures, making interaction mechanisms more flexible—though not eliminating centralization, but ****recasting it**. Rather, it reformulates them in a digital format, while Lewin's organizational change model focuses more on the idea of creating incentives for change by facilitating interaction between leadership and employees through the adoption of digitization tools.

Item two recorded estimated statistical results (Mean = 4.14, Standard Deviation = 0.69), which are values indicating a modest acknowledgment of the ability of digitization to enhance the quality of administrative decision-making by providing accurate data and advanced analytics. This aligns with the principles of transformational leadership, which highlight the role of motivation and institutional development through the use of technology. However, the average level of agreement reflects potential reservations attributed to resistance to change, stemming from traditional organizational cultures or a lack of digital competencies, as indicated by the study (Dhandar, 2024), which pointed out the challenges of implementing e-government in bureaucratic institutions. This

hesitation reflects doubts about the effectiveness of digital tools in improving the essence of decision-making, especially in light of a technical skills gap among the studied sample. Most employees, according to education levels, lack the ability to analyze data and use it strategically.

This reality explains, according to the study (Gräfe et al., 2024), the contradiction between the availability of data and its actual application in decision-making, and highlights the concept of “invisible work,” which includes data validation and interpretation—work that is often overlooked despite its crucial role in the accuracy of information. This is confirmed by the study (Shovkovyy, 2024), emphasizing the need to build technical competence through continuous training. It also points out that digitization may reproduce bureaucratic complexities in modern forms, such as system failures in accurately processing data.

Theoretically, these results challenge one of the principles of bureaucratic theory, which assumes that decisions in an institution are based on objective, data-driven rules. However, the weakness in employees' ability to analyze data reproduces reliance on personal expertise, reflecting the resistance to change addressed by organizational change theory. Additionally, the study—according to results from (Dunleavy et al., 2006)—shows how digital bureaucracy reproduces dialectical contradictions: while it enhances rationality through technology, it reinforces hierarchy through new mechanisms, such as decision-making being monopolized by a few officials, while executive employees (administrative assistants) bear the burden of maintaining and verifying data without being involved in strategic processes.

Regarding **item three**, which recorded a (high mean = 4.08, low standard deviation = 0.79), it is evident that although digitization theoretically has potential to improve decision quality through data, in practice, it led to decision-making being monopolized by a few officials. This reproduces the fundamental contradiction of digital bureaucracy. This aligns with the study (Dunleavy et al., 2006) and (Gräfe et al., 2024), which argue that while technology enhances rationality by providing accurate information, it reinforces hierarchy through new mechanisms—such as concentrating authority in the hands of a few decision-makers, while executive employees bear the burden of “invisible work,” such as maintaining data and ensuring accuracy without this data being used effectively in strategic decisions.

This reality contradicts the principle of bureaucratic organization theory regarding objectivity, where decisions remain influenced by personal relationships. It also reflects resistance to change, as highlighted in Kotter's model within organizational change theory. On the other hand, the high approval rate indicates a significant proportion of employees recognize the role of digitization in enhancing administrative oversight and transparency, aligning with (Setyawan, 2024)'s study on reducing corruption through digital systems. However, this oversight does not represent a change in the nature of hierarchical authority but rather reinforces it through more effective tools.

This directly embodies bureaucratic theory, where technology is used to enforce formal rules (like digital records) rather than redesigning processes through flexible approaches. The paradox, as highlighted by the study (Shovkovyy, 2024), is that digitization announces “digital flexibility” in administrative operations but in reality, reproduces traditional bureaucratic features like command chains and centralized control. This increases pressure on executive employees who carry the burden of maintaining data without being involved in decision-making, exacerbating the gap between information availability and implementation quality.

Item four recorded (Mean = 3.88, SD = 0.79), reflecting a generally positive view among respondents that digital technology has partially enhanced administrative motivation, but has not achieved a comprehensive transformation. Institutions continue to rely on traditional methods such as monetary rewards or formal recognition. From a transformational leadership theory perspective, this reality reflects the overlap between digital tools and classical methods, where technology is used to facilitate procedural tasks (like performance monitoring via digital systems) rather than being integrated into building supportive relationships and stimulating creativity for a segment of employees. Meanwhile, a sample of respondents (administrative assistants) do not view digitization as an effective motivation tool; they feel it deepens the sense of surveillance without offering human support. This reality aligns with the concept of “user isolation due to impersonal interactions,” as indicated by (Shovkovyy, 2024), where institutions neglect emotional and direct interaction aspects in digital work environments.

This reluctance is attributed to limitations in digital infrastructure and the capabilities of a significant portion of respondents (secondary or university degree holders) to use digital motivation tools such as virtual points or electronic certificates effectively to boost morale. Theoretically, this contradiction reveals a weak application of transformational leadership principles in the studied context, as leaders (officials) lack the digital skills needed to turn technology into a lever for motivating employees. The theory focuses on individual inspiration and fostering creativity, but here digitization is used as a surveillance tool rather than a means to build a supportive culture, which reproduces challenges addressed by organizational change theory in Kotter’s model regarding the need to redesign processes to integrate technology with human development.

Regarding **item five**, which recorded an agreement rate of 51.42%, (Mean = 3.97, SD = 0.82), these results indicate respondents’ perception that digitization partially facilitated the distribution of administrative tasks but did not achieve full consensus on its effectiveness. This aligns with (Shovkovyy, 2024)’s study showing how electronic bureaucracy reproduces traditional organizational complexities in a digital environment, such as difficulties navigating systems or duplicating administrative processes. This result highlights the gap between owning digital tools (like project management applications) and their ability to change the core of administrative work. This challenge requires process redesign and a shift in organizational culture—not just the integration of technology. The weak approval can be explained by two main factors: First, deep-rooted resistance to changing work methods, especially among experienced employees who view digitization as a threat to traditional structures and hierarchical authority. Second, a lack of technical competencies, as a portion of respondents with academic degrees lack the necessary skills to efficiently use digital project management tools, diminishing the benefits of automatic task distribution.

Theoretically, this result represents the “change” phase in Lewin’s model of organizational change theory, where the institution has succeeded in “unfreezing” by adopting technology but struggles to establish new practices. This hesitation is also attributed to the poor application of organizational flexibility principles emphasized in Kotter’s model, where digital transformation requires reduced hierarchical centralization and greater focus on teamwork and participation. This has not been achieved under the hybrid structure, according to (Dunleavy et al., 2006), which combines traditional approaches and digital flexibility in an unbalanced way.

The combination of traditional bureaucracy (favoring routine and control) and digitization (which promises flexibility) leads to mixed outcomes, such as duplication of tasks across

digital and paper systems or ignoring employee feedback in tool design. Therefore, merely integrating technology is not enough to achieve the efficiency promised by bureaucratic theory; rather, it requires a redefinition of employee roles and training them to use digital tools in a supportive cultural context, as demonstrated in case studies from India.

Item six recorded statistics (Mean = 4.02, SD = 0.74), indicating a relative improvement in complaint processing through digital technology, which supports the concept of digital governance based on monitoring tools and immediate interaction to enhance efficiency and transparency. Socially, the reduction of repetitive paperwork is seen as one of the most tangible benefits of digitization, as it freed up time and reduced staff exhaustion, leading to a generally positive perception—even amidst continued traditional leadership complexities. This reality aligns with the results of the study (Seta et al., 2024), which found that successes recorded in Germany and Indonesia were achieved through the digitization of routine procedures, contributing to cost reduction and increased efficiency. From the perspective of organizational change theory, this outcome is an example of "early wins" that encourage employees to accept digital transformation, as it yields immediate improvements in daily operations.

However, there is limited consensus among respondents, expressing those digital responses still do not substitute for personal interaction, reaffirming the concept of "invisible work" as outlined by (Gräfe et al., 2024)—stemming from maintaining digital complaint systems and developing the necessary skills to manage them. Similarly, the study (Kalinichenko, 2024) argues that system failures in some contexts are tied to their general design without considering local cultural or administrative characteristics. This reflects what was observed with the dominance of long-experienced staff in key administrative positions, especially in institutions where lower education levels prevail. These staff members often lack the competencies needed to use digital complaint-handling tools effectively, leading to resistance from employees accustomed to traditional methods, which hinders the application of digital governance principles based on automated monitoring and analysis in handling complex complaints that require personal negotiation.

In conclusion, the current state of the institution shows that the combination of traditional bureaucracy (favoring routine) and digitization (promising flexibility) leads to conflicts such as duplication of processes across digital and paper platforms, or a lack of transparency in handling complex complaints within the public institution.

Item seven recorded statistics (Mean = 4.11, SD = 0.91), pointing to a notable contradiction between the high mean and low actual agreement level on the assumption that digitization has improved the institution's ability to quickly respond to changing work environment conditions. This contradiction reflects a sharp divide in employee opinions—as indicated by the low standard deviation—suggesting deep sociological disparities within the respondent population, linked to factors such as education level, traditional experience, and digital skills. From the perspective of organizational change theory, this reflects a conflict between "early successes" achieved by the tech-savvy minority and the "cultural inertia" of employees with long experience or lower educational levels. A considerable group of respondents clearly perceived the benefits of digitization in speeding up information flow and improving environmental responsiveness, especially those in positions that require proficient use of digital tools. This positive perception aligns with the digital governance concept, which relies on monitoring and analysis systems for rapid decision-making, as indicated by previous studies (Seta et al., 2024).

However, the majority reject the idea that digitization increased flexibility, as long-experienced employees perceive new systems as complex or rigid, imposing unfamiliar procedures that slow their administrative response. This reality highlights the challenge of invisible work, mentioned in (Gräfe et al., 2024), stemming from maintaining digital systems and accumulating traditional organizational complexities within the digital environment—thus laying the groundwork for electronic bureaucracy inside institutions. The polarization in responses on this item also exposes the issue of "digital inequality" within the institution itself. Not all employees have equal access to benefit from technology due to differences in skills or access to training. This was noted in the study (Kalinichenko, 2024), which analyzed the generational digital divide.

According to organizational change theory, designing flexible processes and training employees to use digital tools are necessary conditions to achieve the desired flexibility, particularly for older generations who cling to a culture of caution and routine.

Item eight recorded statistics (Mean = 4.11, SD = 0.90), indicating that digitization significantly contributed to improving administrative efficiency through simplifying routine procedures. This direct benefit is one of the most tangible gains felt by employees, especially administrative assistants, as digitization reduced the need for paperwork, made file access easier, and minimized repetitive tasks through automated processes. This reflects how digitization can “repair” the negative aspects of traditional bureaucracy while preserving its core principles (official records and standardized procedures). This is consistent with the findings of (Dunleavy et al., 2006), which emphasized the concept of digital bureaucracy, integrating technology with hierarchical structure to enhance efficiency.

According to Kotter’s model in change theory, this result is a successful example of "early victories" that reinforce acceptance of digital transformation. Immediate improvements in daily operations reduce resistance among experienced employees and build momentum to adopt change in more complex areas. This vision also aligns with bureaucratic organization theory, showing how digitization can fulfill bureaucracy’s primary promise—efficiency—better than the classical model, by replacing paper complexity with automated digital systems, without abandoning specialization and hierarchical structure. Despite the high approval rate among respondents, results also indicate that some employees still face challenges in adapting to technology due to cultural resistance or a lack of digital skills, often tied to system maintenance and accumulating traditional complexities in the digital environment, according to (Kalinichenko, 2024). This underscores the gap between the general system design and local needs, leading to tension between different generations of employees. Older staff see digitization as imposing unfamiliar procedures, while younger staff benefit from easy information access—hindering effective response unless supported by comprehensive training.

In general, the results in this item confirmed that digitization has reduced procedural complexity but has not addressed the roots of resistance to change, such as fear of losing control or lack of trust in digital systems. Some processes still rely on personal experience rather than full reliance on digital applications.

3. Presentation and Discussion of Study Results – Axis Three:

Table (5): Presents the means and standard deviations of the study sample categories’ estimations of the **functional and organizational challenges** facing leadership during the implementation of **bureaucratic digitization Regulatory and Functional Obstacles**

Statement	Frequency	Percentage	Mean	Std. Dev.	Rank
Management faces employee resistance to the implementation of digitalization within the institution.	18	50.85	3.37	1.26	Strongly Disagree
Not all managers in the administration possess the necessary digital competencies to keep up with the digital transformation.	16	45.71	3.77	0.97	Disagree
There is a lack of training programs that help managers and employees in the administration to adapt to digitalization.	21	60.00	4.40	0.49	Disagree
Weak technological infrastructure such as internet outages and lack of devices reduces the effectiveness of digitalization implementation within the institution.	18	51.42	4.48	0.56	Strongly Disagree
The current work culture does not align with the requirements for digital implementation.	13	37.14	3.45	1.17	Disagree
There is a delay in decision-making by the institution's management regarding the implementation of digitalization.	12	34.28	3.60	1.14	Disagree
Managers face difficulties convincing employees of the benefits of digitalization.	11	31.42	3.60	1.11	Disagree

Source: Prepared by the researcher based on JASP software

The general observation from the overall results in the table indicates that the application of digital technology in the Municipality of "Omar" in the state of Touggourt reflects the functional and organizational challenges faced by leadership during its implementation, as shown by the following results:

Regarding **the first** item (Mean = 3.37, Standard Deviation = 1.26), the results indicate moderate employee resistance to digitalization, a characteristic recorded in the literature on digital bureaucracy. This aligns with the results of studies by (Gräfe et al., 2024) and (Dhandar, 2024). This can be explained through the lens of organizational change theory according to Kotter's model, where this resistance is seen as an unfreezing stage where employees face a threat to their professional identity and entrenched practices. However, the study revealed an important sociological paradox: despite the traditional characteristics of respondents (such as the dominance of long-experienced administrative agents), most respondents denied the existence of resistance. This can be explained in several ways, including that this denial may reflect successful leadership in creating motivation for change or a defensive mechanism denying the conflict to avoid criticism. This reality contradicts (Dhandar, 2024) in India, which confirmed bureaucratic resistance as a major obstacle to e-government, suggesting a "silent" and unannounced resistance in the Algerian context. Employees, especially administrative agents, may see

themselves as implementers of decisions rather than part of the decision-making circle, which explains their personal denial of resistance despite its institutional presence.

The contradiction between the traditional structure and digital transformation relates to three main factors. Observations show that Algerian institutions remain saturated with the traditional bureaucratic model. Any attempt at digitalization within the institution is considered a reshaping of power balances and administrative practices. Older employees lack the necessary skills to use digital tools, which (Gräfe et al., 2024) described as "invisible work" that increases their job anxiety. Additionally, (Shovkovyy, 2024) noted that employees with limited qualifications struggle to adapt to digital tools, reproducing "electronic bureaucracy" with traditional complexities via unfamiliar digital interfaces.

Regarding the **second item** (Mean = 3.77, Standard Deviation = 0.97), it indicates a relative consensus among respondents that leaders lack the necessary digital competencies, embodying the challenge of transitioning from traditional management to digital leadership. This reality contradicts the principles of transformational leadership theory, which emphasizes that leaders must model technology use and motivate their teams with a clear digital vision. This relates directly to the organizational structure of the respondents, where service officials represent a small percentage compared to executive roles and are unable to provide a clear digital vision or stimulate creativity, weakening the institution's ability to adapt to modern transformations. This aligns with (Sadykova & Galy, 2024), which links weak digital competencies to traditional hierarchical structures where technical skills are marginalized in leader selection, reproducing bureaucracy in digital forms.

Despite negative indicators, respondents also showed a somewhat high degree of confidence in the digital competencies of leaders. This raises questions when compared to the educational and skill background of leaders. In bureaucratic organizational theory, appointment based on competence and skill is fundamental. However, respondents' answers superficially support this principle without reflecting the reality of the digital gap. This confidence may reflect a positive reality or low awareness of what "necessary digital competencies" actually require, such as data analysis or managing complex systems. These results thus demonstrate how entrenched hierarchical structures hinder the development of digital competencies by favoring appointments based on long experience rather than technical skills, weakening the institution's ability to meet digital age demands.

The **third item** shows statistics of (Mean = 4.40, Standard Deviation = 0.49), highlighting a strong consensus on the lack of training programs that prepare employees and leaders for digital transformation, representing a challenge that obstructs institutional progress. According to organizational change theory, successful digital transformation requires building employee competencies through continuous training and educational support. However, most respondents (both secondary and university levels) need advanced training to keep up with complex digital tools. This contradicts successful experiences like Indonesia's, as indicated by (Seta et al., 2024), where intensive training programs accelerated digital tool adoption.

From a bureaucratic organization theory perspective, the absence of formal policies to build a digital culture reproduces traditional organizational complexities in a digital environment, weakening the institution's ability to achieve the efficiency promised by digitalization. This is explained by the traditional characteristics of the sample (such as dominance of older age groups with long experience) who denied employee resistance to digitalization, which is a sociological paradox. From the organizational change theory

perspective, this denial might reflect successful leadership in creating motivation for change or a defensive mechanism denying conflict to avoid criticism.

The **fourth item** with statistics (Mean = 4.48, Standard Deviation = 0.56) shows results indicating that internet outages and lack of devices are major obstacles to digitalization implementation. This aligns with (Kalinichenko, 2024), which links weak infrastructure and general structural shortcomings in Algerian public institutions in remote areas, where geographic isolation and lack of funding exacerbate the problem. This is one of the main obstacles to digital transformation in Algerian public institutions, where employees lack stable internet and modern devices, reproducing the digital divide between urban and rural areas and weakening inclusivity in good governance, as indicated by (Setyawan, 2024) on infrastructure challenges in developing countries.

From a bureaucratic organizational theory perspective, any technological modernization remains dependent on the organizational environment, and the superstructure cannot function effectively over a deteriorated infrastructure, explaining the persistence of traditional organizational complexities within these environments. Despite negative expectations regarding infrastructure problems, a large proportion of the sample denied these issues, a sociological paradox that can be explained in two ways: first, the infrastructure may be adequate for the current limited level of digital use due to low skills or resistance to change; second, respondents' desire to present a positive image of the institution, especially administrative agents who represent the majority, considering themselves decision executors rather than decision-makers. This contrasts with successful experiences like Indonesia, where committed leadership developed infrastructure as a prerequisite to digital potential realization, as expressed by (Seta et al., 2024). Thus, the absence of a supportive technical environment paves the way for exacerbated resistance to digital transformation, especially when modern technologies do not align with local needs.

The **fifth item** (Mean = 3.45, Standard Deviation = 1.17) indicates a deep cultural gap hindering the integration of modern technologies in Algerian public institutions, where organizational culture remains saturated with traditional bureaucratic values such as hierarchy, seniority respect, compliance, and centralization. This contradicts the requirements of flexible digitalization, which focuses on collaboration and innovation, as indicated by (Dunleavy et al., 2006). Although a considerable number of employees believe the organizational culture aligns with digitalization, the adopted culture is the strongest barrier to its adoption in the Algerian context. The problem worsens with the dominance of males and older generations who maintain traditional values and oppose new digital practices, conflicting with the "flexibility" principles in organizational change theories. This explains the high denial among employees as a defensive mechanism denying conflict existence.

On the other hand, transformational leadership theory indicates that changing organizational culture is a central goal for leaders, requiring motivation for creativity and changing entrenched values. However, in Algerian institutions, employees' lack of awareness of the cultural gap is a greater challenge, reflecting a lack of internal motivation for change, weakening leadership efforts to build a "continuous organizational learning" environment supporting digitalization. This aligns with (Afrilia et al., 2024), which confirmed that Indonesia's digital transformation success depended on integrating local values, while India failed due to neglecting this dimension. In Algeria, where organizational culture is centralized and resistant to innovation, this gap is reinforced. Leaders lack digital competencies and strategic vision to reshape culture.

Regarding the **sixth item** (Mean = 3.60, Standard Deviation = 1.14), it indicates a problem with administrative performance flexibility within the institution, where institutional culture rooted in bureaucratic hierarchy and repetitive procedures hinders rapid digital decision-making. This aligns with (Sadykova & Galy, 2024), which confirmed that weak leadership procedures against digital decisions slow organizational transformation, especially in institutions with strong cultural resistance and centralized administration, a common case in developing countries. From transformational leadership theory perspective, lack of delegation and strategic vision empties digitalization discourse of its content and reinforces a culture of "organizational symbolism" instead of actual implementation, reflecting traditional leadership models in desert societies. Thus, bureaucratic organizational theory sees adherence to formal procedures and central authority within the institution as reproducing traditional organizational complexities in the adopted digital environment, weakening the institution's ability to achieve the flexibility promised by digitalization. However, many employees, especially administrative agents, believe decision-making is not slow. These responses can be explained by two premises: first, employees' limited view of implementation rather than decision-making, as they only perceive the moment of the final decision issuance without understanding the complexities of prior stages; second, hasty decision-making without sufficient planning, potentially leading to implementation challenges, as warned by (Dhandar, 2024) in e-government failure within traditionally cultured institutions.

The results also reveal that the organizational culture in the studied context remains saturated with traditional bureaucratic values such as hierarchy, seniority respect, compliance, and centralization. According to organizational change theory, overcoming this culture requires building a "continuous organizational learning" environment supporting creativity and openness to new digital practices by all employees without exception.

It is noted that item seven came with statistics estimated at (Mean = 3.60, Standard Deviation = 1.11), which are results revealing the trust gap between leadership and employees through the dominance of executive roles in the sample of respondents and the insufficient representation of leaders, reflecting the issue of "formal digital discourse" without real structural change. Therefore, the slow pace of digital decision-making within the institution is usually linked to weak communication between leadership and employees, as the sample lacks leaders capable of providing a digital vision, which weakens the motivation for transformation towards it. This reality embodies the concept of slow bureaucracy according to bureaucratic organization theory, where traditional organizational complexities continue to penetrate digital bureaucracy despite the adoption of digital technologies within management components, as administrative decisions here pass-through multiple levels of approval, hindering the speed of response to the demands of the digital age, especially given the weak flexibility of leadership and its digital capabilities.

Transformational leadership theory confirms that success in digital transformation requires motivating employees through a clear and shared vision, but responses show that they believe leadership is successful in persuasion, which may be explained in several ways, including that digitalization within the institution focuses on simplifying current procedures without touching power relations or traditional structures, making employee persuasion easy, or that there is a widespread lack of awareness among employees of the deep challenges imposed by the organizational culture within the institution, where employees do not realize the contradiction between digital discourse and organizational reality.

- **Study results in light of the first hypothesis:** Digital bureaucracy in public administration contributes to reshaping traditional administrative leadership concepts towards concepts of transparency, participation, and innovation.

By analyzing each item in the study results table, it becomes clear that there is relative acceptance of digital transformation in administrative leadership concepts, but it is still limited to formal or technological aspects such as transparency and communication, while cultural, organizational, and leadership dimensions remain far from full transformation. This reality is due to a set of factors related to the psychometric characteristics of the sample, such as low educational level, predominance of traditional experience, and weak representation of leadership roles, which are obstacles to actual digital transformation. Therefore, the necessity arises for strong leadership will and a supportive organizational culture to develop real digital leadership practices within the institution.

- **Study results in light of the second hypothesis:** Applying digital bureaucracy improves administrative leadership practices by enhancing communication, decision-making, and performance efficiency within public administration.

The results show that digital transformation in Algerian public institutions, especially in desert contexts, does not eliminate the traditional bureaucratic structure but reshapes it, consolidating three fundamental sociological issues: First, the reproduction of hierarchies through the centralization of digital decision-making and elite monopoly, as digital tools reinforce hierarchical authority instead of dismantling it; second, the marginalization of women and executive employees, evident in the weak representation of women in leadership positions alongside increased pressures on administrative agents by maintaining digital systems without recognition of their contributions; third and finally, the contextual gap between applied technology and local environmental needs, where digital tools lack adaptation to the cultural and geographical characteristics of desert areas, weakening their effectiveness despite available infrastructure.

- **Study results in light of the third hypothesis:** Leadership in public administration faces functional and organizational challenges in applying digital bureaucracy including resistance to change, lack of digital competencies, and insufficient technical infrastructure.

Results show that challenges to applying digital bureaucracy in the Omar municipality (Touggourt province) stem from a complex interaction between structural factors such as hierarchical structure and traditional experience, cultural factors like cultural resistance and lack of training, and technological factors such as weak infrastructure. This reality confirms that digital transformation in public institutions is not limited to the technical aspect but extends to reshaping organizational, cultural, and leadership relations. The studied sample, dominated by older age groups and males with a lack of digital competencies, highlights that digitalization is not just technological updating but a comprehensive cultural and administrative transformation requiring leadership rehabilitation and modification of entrenched institutional habits.

4- Conclusion

The study results show that digital bureaucracy in Algerian public institutions, especially in desert contexts like Omar municipality in Touggourt province, reshapes traditional administrative leadership concepts toward principles of transparency, participation, and innovation, but faces fundamental challenges limiting its effectiveness. There is a complex interaction between technology and organizational culture, with relative acceptance of integrating digital tools in administrative processes (such as electronic platforms and data analysis), especially in improving communication,

accelerating information exchange, and reducing administrative delays. However, traditional bureaucratic structures reinforced by hierarchical relationships and centralized authority remain obstacles to transforming digitalization into a strategic tool to empower employees and enhance participation. The study reveals a paradox between official digital discourse (which calls for transparency and flexibility) and structural reality, where digital tools reproduce traditional structures in a new form, with elite control over decision-making and an increasing gap between leaders and executive employees.

The study also uncovered digital transformation challenges facing the institution, notably cultural and human barriers such as resistance from long-experienced employees to change and weak digital competencies, in addition to infrastructural constraints that weaken the compatibility of digital tools with the geographical and cultural characteristics of desert regions. Additionally, transformational leadership is weak due to the absence of a clear strategic vision for integrating technology with social dynamics, leading to adopting digitalization as a tactical solution rather than a comprehensive organizational reengineering process. On the other hand, results show that administrative leadership in the Algerian context has not yet transformed into an effective agent of bureaucratic mindset change due to the absence of strong will to adopt transformational leadership principles (such as inspiration, collective activation, and encouraging innovation). Furthermore, digitalization did not abolish the hierarchical structure but reshaped it digitally, with continued concentration of power and exacerbation of marginalization of vulnerable groups (such as women and executive workers), which calls for implicit review of various strategies adopted by the government in digitizing its sectors and institutions to avoid the persistence of these issues.

Accordingly, based on these results, the study proposes recommendations aiming to strengthen leadership by training leaders to use digital tools to enhance communication and participation (such as virtual collaboration platforms) and linking technology to achieving organizational and cultural objectives. In addition, the study emphasizes the necessity of building a supportive organizational culture for digitalization through developing specialized training programs to raise employee efficiency in using technology, focusing on older age groups struggling to adapt, encouraging a culture of accountability and innovation by rewarding new ideas and integrating employee opinions in designing digital solutions appropriate for the local context. Finally, it proposes improving infrastructure and digital policies by allocating investments to develop digital infrastructure in desert areas while considering geographical and cultural characteristics, and restructuring organizational structures to reduce centralization and increase decision-making flexibility, according to the "hybrid organization" model balancing bureaucratic efficiency and digital flexibility.

Despite the importance of these results and recommendations, the study has theoretical and practical limitations requiring further deepening in the future. Theoretically, the study was limited to a framework combining Lewin's organizational change model, bureaucracy theory, and transformational leadership theory principles without exploring other models (such as good governance theory or organizational agility model). Future studies need to link digitization topics to broader theoretical contexts, such as "complex adaptation" theory or "digital ecosystem" theory, to understand dynamic interactions between technology and organizational culture. Practically, the study's scope was limited to one municipality, limiting the generalizability of results to public institutions in Algeria. This necessitates future studies to expand the sample to include multiple urban and rural institutions, using diverse field methodologies (such as comparative studies or quantitative modeling).

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