

Technological Mediation and Digital Capital: A Study of Communicative Adaptation and Network Readiness among Organizational Actors at the Port Enterprise of Skikda.

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Received: 14.03.2026

Accepted: 16.08.2026

Published: 02.10.2026

ABSTRACT

This field study aimed to explore the manifestations of technological mediation and digital capital, and to examine the impact of network readiness on communicative adaptation and integration challenges among organizational actors within a port enterprise. The study adopted the descriptive-analytical method, with data collected through a questionnaire administered to a purposive sample of 69 employees and workers at the enterprise.

The field results relating to the first hypothesis revealed a clear descending hierarchy in communicative practice and reliance on administrative media: the computer ranked first, present in 95.7% of respondents' offices, with its uses distributed among producing administrative reports and correspondence (21.67%), file transfer (20.77%), and statistical operations (17.60%). The Internet ranked second, with a connection rate of 59.4%, its use concentrated in data exchange (40.6%) and facilitating communication with clients (20.59%). By contrast, reliance on the intranet as a channel for internal communication declined to 15.30% in favor of traditional channels such as meetings and telephone (18.03%), while the extranet was found to be entirely absent from the institution's extended organizational practice.

The results of the second hypothesis confirmed that the requirements for network readiness and communicative adaptation for intranet implementation were met: 68.11% reported having network access available in their offices, and 52.17% reported regular use. Temporal analysis confirmed the entrenchment of digital culture within the enterprise, with 59.43% of respondents connected to the internal network for an extended period of nineteen years (18 years) [as reported], while 95.65% agreed on the utmost necessity of its use. Regarding skill development, 55.07% reported having received qualified training in the use of computers and databases.

The study recommends moving from “closed computerization” toward the comprehensive activation of the extended network infrastructure (extranet), and moving beyond direct classical communication by integrating digital videoconferencing — which the results showed to be organizationally absent, with a non-occurrence rate of 84.05%.

Keywords: technological mediation, digital capital, communicative adaptation, network readiness, port enterprise.

Introduction

Technological mediation represents, in contemporary sociological thought, the pivotal axis in the restructuring of administrative organizations and the deconstruction of the dynamics of power and interaction within institutions, since the communicative environment is no longer merely a technical carrier for transmitting messages, but has become a space that reproduces organizational practices and shapes the pathways of communicative adaptation among actors. Building on this structural transformation, which is confirmed by the international literature, investment in electronic management tools is no longer governed solely by the logic of operational efficiency, but has come to represent a criterion of organizational digital capital and of an institution's capacity to transition toward a 'network structure.' Despite the accumulation of recent national and Arab academic literature and theses addressing managerial digitization, this body of work has remained confined to technocratic-functional approaches, with most studies focusing on the dimensions of facility modernization, performance measurement, and service quality — thereby overlooking the sociological-communicative analysis of how actors represent and appropriate these media, from the computer to the extranet. It is precisely within this epistemological context that the research gap addressed by the present study takes shape: it moves beyond a reductive, descriptive treatment of electronic management to offer a deep sociometric and psycho-organizational deconstruction of 'network readiness' indicators and communicative adaptation among field actors within the port enterprise, exploring the challenges of integration and the obstacles to external network extension within the organizational environment.

Within the framework of theoretical approaches in the sociology of communication, the scientific deconstruction of the phenomenon of electronic management and its networked practices requires moving beyond simple lexical definitions toward a sociological analytical horizon that interprets it as a communicative environment shaping work rules and patterns of organizational interaction. This phenomenon is theoretically grounded in a continuum linking the properties of technology to the agency of individuals. On one hand, Marshall McLuhan's theory of technological determinism provides an intellectual foundation that approaches the extranet and digital media as extensions of human capacities and organizational structures, whereby the communicative medium becomes a decisive element that imposes its requirements on modes of thought and administrative coordination, thereby determining actors' levels of communicative adaptation and orienting their functional behavior toward network use (Dalioul, 2010, p. 62). This perspective, which emphasizes the power of technological influence, is epistemologically complemented by uses-and-gratifications theory, which restores consideration of the organizational actor as an active element and selective practitioner possessing the capacity and intentionality to choose digital media and deploy electronic management techniques to meet specific cognitive, organizational, and administrative needs. Between the structural influence of technology and the selective agency of users, the dependent variable of this study is defined as a product of the interaction between the requirements of the digital environment and the communicative practices of actors in achieving organizational adaptation (Saad, 2008).

The independent variable of this study — technological mediation and digital capital — is grounded in sociological frameworks that interpret technology as a decisive variable in reshaping work relations and organizational interaction dynamics. The theoretical approach to this variable draws on Everett Rogers's diffusion of innovations theory, which treats electronic management techniques and extended networks (extranet) as organizational innovations whose adoption and dissemination pass through successive stages — knowledge, persuasion, and the decision to use — culminating in a stage of 'routine adaptation' within the institution. This theory reveals that field actors' capacity to adopt these innovations varies according to their digital capital and professional backgrounds (Abu Asba, 1999). This vision is further completed by drawing on DeFleur and Rokeach's media dependency theory, which shows how the dependence of the organization and its members on information systems reinforces the need for direct access to data, thereby reordering actors' roles and determining their level of network readiness. Accordingly, the independent variable is measured not merely by the presence of technical infrastructure, but by how digital capital is formed and the extent to which actors rely on digital media as a fundamental pillar for managing transactions and conducting communicative interaction (Murad, 2011).

On this dual theoretical grounding, the relationship between the independent and dependent variables is defined as a dynamic relationship of mutual influence, whereby technological mediation and digital capital constitute the primary enabler and explanatory condition for achieving communicative adaptation and the use of electronic management within the organizational environment. Sociological and communication approaches explain the expected basis of this relationship through mechanisms of "dependency and usage empowerment": a higher level of network readiness and accumulated digital capital among actors reduces resistance to change and facilitates the integration of extranet technologies into daily practices, which is directly reflected in improved communicative coordination efficiency and the overcoming of organizational obstacles. The literature and scientific studies in this context agree that the adoption of digital innovations does not depend solely on the availability of technology itself, but is linked to the degree of interdependence between actors and digital media in meeting functional and cognitive needs, as organizational research has revealed that increased reliance on information networks contributes to reshaping communicative interactions and transforming use from mere formal procedural compliance into genuine communicative adaptation that strengthens network integration and improves the management of communicative flows within the organization.

The academic field has witnessed growing interest in tracking the transformations of electronic management and digitization, with the relevant literature addressing this trajectory through multiple approaches. Claude and Ksouri (2024), in their study entitled "The Inevitability of the Transition toward Digital Governance for the Modernization and Rationalization of Public Service in Algeria," sought to highlight the inevitability of digital transformation for modernizing and rationalizing public service. Their analysis focused on the conceptual framework of digital governance and its procedural role in reducing bureaucracy, relying on the descriptive-analytical method and modern public-management approaches; however, this study focused on procedural aspects and overlooked the mechanisms of organizational interaction and the building of self-immunity, while also addressing organizational and legislative dimensions (Claude & Ksouri, 2024).

The study by Toufik and Ouail (2022) on “The Reality of Electronic Management in Algeria” was directed toward diagnosing the reality, requirements, and obstacles of modernization in the public sectors, examining applied models of electronic services and technical and organizational obstacles on the basis of the descriptive method and theories of administrative modernization; however, it was limited to observing direct service outputs without delving into the dynamics of structural adaptation and organizational resistance (Toufik & Ouail, 2022).

This section is methodologically grounded in a critical review of these works in order to highlight the precise research gap represented by the near-total absence, within the limits of the available scientific literature, of sociological studies that move digital technology beyond a mere procedural means for facilitating services toward a structural variable contributing to the formation of “organizational immunity” within institutions and the public and private sectors, and toward understanding how relations, authority, and self-regulation are redrawn within administrative organization.

From this standpoint, the scientific need for the present study is defined as filling this conceptual and empirical gap, resting on linking modern communication technology with organizational immunity through the lens of organizational sociology. The scope of the present study is thus defined as moving beyond technical readings to investigate how digital applications and communication networks become defensive mechanisms and proactive strategies that protect institutions and sectors (public and private) from bureaucratic fragility and enhance their capacity for adaptation. This study derives its applied and value-based significance from its direct positioning within the depth of the developmental dynamic witnessed by the Algerian local and national context, represented by the state’s strategic orientation toward accelerating digital transformation and modernizing economic and service institutions. The field significance of the study is evident in shedding light on one of the largest and most vital economic facilities in Algeria — the Port Enterprise of the Wilaya of Skikda — as a critical artery for foreign trade and a fundamental driver of the local and national economic fabric.

The direct value of this study lies in analyzing how modern communication technology and digital systems are deployed within this strategic institution, not only as tools for accelerating port and customs transactions, but as a mechanism for building “organizational immunity” that safeguards the institution against operational risks, logistical crises, and bureaucratic loopholes that could affect national supply chains.

Accordingly, the applied significance extends beyond the organizational walls of the Port of Skikda to encompass the wider society and local environment, as improving the organizational immunity and digital responsiveness of the port enterprise contributes to:

1. Supporting the local and national economy: by enhancing the fluidity of goods movement, reducing shipping and delay costs, and raising the competitiveness of the Algerian port facility.
2. Improving the environment of transparent, service-oriented transactions: protecting economic operators and citizens from routine practices, and establishing a management style based on digital governance and speed in decision-making.
3. Providing a generalizable applied model: supplying a database and field outputs for decision-makers and officials responsible for managing ports and vital sectors in Algeria, enabling them to formulate communicative and digital strategies that enhance the capacity of Algerian institutions to adapt to environmental shocks and accelerating technological change.

On this basis, the study derives its legitimacy from being an actual response to the requirements of the Algerian local reality, seeking to provide a diagnostic and remedial vision that reflects the added value of organizational sociology in the service of sustainable development and national institutions, providing contemporary explanatory frameworks suited to the strategic dimension of resistance to shocks in the administrative environment and to the reality of digital transformation.

This study seeks primarily to provide a contemporary scientific contribution that enriches the literature of organizational sociology and digital management, by moving beyond classical procedural readings that limit digital media to dry public-service tools, and shifting the approach to a deeper analytical level linking modern communication technology to the construction of organizational immunity. The desired scientific contribution is manifested in providing an explanatory framework that clarifies how digital applications and communication networks can be transformed into defensive and structural mechanisms enabling the economic institution to achieve proactive adaptation and resist bureaucratic imbalances and environmental crises. This contribution is completed, on its applied side, by producing precise field indicators that benefit decision-makers and executives of the Port Enterprise of Skikda and similar institutions in restructuring their digital communicative environment, thereby ensuring the sustainability of performance and raising the efficiency of this vital facility.

Building on this logical trajectory, which proceeds from theoretical exposition and the research gap toward field embodiment, the study moves from its foundational dimensions to the procedural methodological framework for deconstructing the phenomenon and testing its variables. Accordingly, the central research question is formulated as follows:

- How do modern communication technology tools (electronic management in its network dimensions) contribute to enhancing the organizational immunity of the Port Enterprise of Skikda?

To answer this central question and test the field relationships between the variables, the general hypothesis and the sub-hypotheses of the study were formulated as follows:

- General hypothesis: There is a statistically significant variation and effect in the extent of use of modern communication technology/electronic management tools (the computer, the intranet, the Internet, and the extranet) on the building of organizational immunity within the port enterprise.
- First sub-hypothesis: The computer ranks first in terms of use in the communicative and organizational operations of the port enterprise.
- Second sub-hypothesis: The intranet ranks second in terms of internal use and reliance.
- Third sub-hypothesis: The Internet ranks third in terms of use in transactions and communication.
- Fourth sub-hypothesis: The extranet ranks last in terms of use and connection with the institution's external environment.

Methodological Procedures of the Study

This section presents the fieldwork and procedural tools adopted to deconstruct the study's problem and test its hypotheses concerning the role of modern communication technology (electronic management) in building and activating organizational immunity.

1. Fields of the Study

- **Spatial field:** The field study was conducted at the Port Enterprise of Skikda (Entreprise Portuaire de Skikda – E.P.S), a public economic (joint-stock) enterprise subject to autonomous operating regulations, and a vital and strategic artery for the local and national economic environment in Algeria.
- **Temporal field:** The temporal origins of the problem and research gap addressed by the study coincide with the early orientation toward digitization and the modernization of administrative transactions at the Port Enterprise of Skikda, whose organizational environment relied for long periods on the bureaucratic model and classical paper-based media in managing communicative flows and processing decisions. With the acceleration of national economic and technological transformations, these classical methods revealed their limitations in responding rapidly to operational crises and the pressures of shipping and maritime trade. With the beginning of expanded investment in digital infrastructure and the adoption of electronic management applications (such as the intranet and the computer) in recent years, an urgent field need emerged to evaluate this transformation — not only from a technical-procedural standpoint, but in terms of its sociological effect in shaping an ‘organizational immunity’ enabling the institution to adapt and recover proactively. This constituted the research gap that took clear shape within the port environment and required comprehensive field investigation.
- **Human field:** The study population consists of the employees and administrative staff distributed across the strategic directorates of the Port Enterprise of Skikda, namely:
 - Directorate of Studies, Marketing and Informatics
 - Directorate of Operations, Transport, Unloading and Loading
 - Directorate of Maintenance
 - Directorate of Works
 - Directorate of Towing
 - Directorate of Finance and Accounting

These respondents are distributed socio-occupationally across various functional categories (execution workers, control workers, and executives/managers).

2. Method of the Study

In keeping with the nature of the phenomenon studied, the descriptive-analytical method was adopted, using the social survey technique, as the most appropriate method for observing the actual use of modern communication technology applications (the computer, the intranet, the Internet, and the extranet), and for diagnosing the resulting level of organizational immunity. This method allows for a precise scientific description of the administrative phenomenon and for moving from the mere phenomenal description of data to sociological analysis that explains the dynamics of structural adaptation and combats bureaucratic dysfunctions within the institution’s organizational environment. In this methodological context, Descartes defines method as: the set of certain and simple rules whose careful observance prevents one from ever taking what is false to be true, and which enable the mind to attain true knowledge of all that it is capable of knowing, without wasted effort (Turki, 2006).

Ben Mersli (2005) likewise notes that positivist research based on this method provides the scientific means enabling the researcher to identify the phenomenon studied in terms of its constituent factors and the relationships prevailing within it, as they exist in real space and under natural conditions (Ben Mersli, 2005).

3. Data Collection Tools

The study relied on one primary tool and one auxiliary tool to collect primary field data:

- **Questionnaire (primary tool):** A questionnaire was designed for employees and executives; its final form comprised four integrated main axes:
 - *First axis:* Personal data and socio-occupational indicators of respondents.
 - *Second axis:* Ranking of the use of communication technology/electronic management tools (computer, intranet, Internet, extranet).
 - *Third axis:* Requirements and challenges of implementing the intranet and internal communication systems.
 - *Fourth axis:* The role of the institution's digital communicative orientation in activating and reinforcing the dimensions of organizational immunity.
- **Scientific observation (auxiliary tool):** Deliberate, direct scientific observation was conducted throughout the fieldwork period at the Port Enterprise of Skikda, to record patterns of daily interaction, the actual extent of reliance on digital networks in managing port transactions, and to interpret manifestations of resistance or organizational adaptation that direct responses to the questionnaire might not reflect.

4. Sample and Sampling Method

The sample is procedurally defined as a limited number of units dealt with systematically to provide the required primary data, on condition that they represent the parent population (Abdel Hamid, 2000). Given the nature of the topic, which centers on specialized use of communication networks and digital management, a purposive (deliberate) sample was used, with a set of methodological criteria adopted to select units possessing direct practice, familiarity, and knowledge of the communicative media under study across the six specified directorates.

The study questionnaire was distributed to 85 respondents across various administrative and socio-occupational levels (managers, department heads, branch heads, control workers, and execution workers). The field retrieval and verification process yielded 69 valid questionnaires for statistical analysis (a final sample size of $N = 69$ respondents), while the difference of 16 questionnaires is attributed to certain field obstacles such as absences, unforeseen disruptions, or incomplete retrieval.

Method of statistical and sociological analysis

To transform the raw field data into scientific and sociological meanings, data analysis combined both quantitative and qualitative approaches:

- **Quantitative approach:** Data were processed statistically using the Statistical Package for the Social Sciences (SPSS, current version), through:
 - Calculating frequencies and percentages to reveal the relative weight of variables.
 - Applying the chi-square test (χ^2) to determine differences and the significance of variation in respondents' answers according to their functional categories, at a significance level of $\alpha \leq 0.05$.
 - Adopting the five-point Likert scale to measure respondents' attitudes (strongly agree, agree, neutral, disagree, strongly disagree).
- **Qualitative (interpretive) approach:** This approach undertakes the reading of statistical figures and indicators and their translation into sociological meanings, by linking the quantitative outputs to the study's conceptual framework, and interpreting how the graduated

use of communication networks (from the computer to the extranet) contributes to enhancing the port enterprise's capacity to build proactive organizational immunity.

Discussion of Results and Sociological Interpretation

The discussion of the field study's results is based on deconstructing the statistical data and translating it into sociological and organizational meanings, in light of the research objectives and the extent to which the formulated field hypotheses were confirmed. This discussion aims to reveal how modern communication technology applications in electronic management shift from mere technical media into defensive mechanisms contributing to building organizational immunity at the Port Enterprise of Skikda.

First: Socio-Occupational Indicators of the Sample in Light of the Communicative Environment

The description of the study sample (N = 69) showed a predominance of males at 65.22% compared to 34.78% for females, a demographic characteristic reflecting the specificity of the port sector and its field operational challenges. Regarding age groups, results showed that the pivotal age group of 30 to 40 years constitutes the largest proportion, at 63.77%, followed by the 41-to-50 age group at 20.29%. This indicator reflects an institution endowed with a human base going through a stage of professional maturity and occupational stability, while at the same time possessing a high capacity for assimilating and adapting to digital culture and modern technologies.

Regarding educational level, results showed a high scientific index among respondents: holders of a bachelor's degree (licence) accounted for 29.28%, higher technicians 27.54%, engineers 14.49%, and postgraduate degree holders 8.69%. This academic advancement is directly reflected in the occupational distribution, led by control workers at 56.52% and institution executives at 30.43%.

These socio-occupational indicators provide a solid basis for interpreting the readiness of the human structure within the Port Enterprise of Skikda, as the qualified and youthful human capital represents the primary channel for activating electronic management applications and absorbing organizational shocks — constituting the first pillar of organizational immunity, namely the adaptive capacity of human capital.

Second: Results in Light of the First Sub-Hypothesis (Ranking of the Use of Communication Technology and the Computer)

The first sub-hypothesis stated that: "The computer represents the first and most widely used pillar in the communicative and organizational transactions and operations of the port enterprise."

Field results clearly confirmed the validity of this hypothesis, with 95.7% of sample members confirming that their offices were equipped with a computer. Its procedural uses varied between producing administrative reports and correspondence (21.67%), transferring files and data (20.77%), obtaining organizational information (20.77%), and conducting operational statistics (17.60%).

Regarding external network connectivity, the data revealed that 59.4% of respondents' devices were connected to the Internet, with usage motives centered on exchanging data and information with external parties (40.6%), facilitating communication with clients and visitors to the port (20.59%), using administrative email (19.33%), and promoting the port enterprise's standing (18.9%). By contrast, 40.6% reported that Internet connectivity was not available in their offices — a practice the sociological approach interprets as a rationalization of use aimed at protecting the institution's information infrastructure from breaches and preventing dispersal of operational flow.

These results show that the computer and the Internet represent the first level of technical interaction, as the computer enables the institution to reduce human error and speed up the processing of interlinked port data. This grants the organizational environment a rapid response capacity to administrative requirements, thereby reinforcing the responsive dimension of organizational immunity in the face of pressures from commercial and service transactions.

Third: Results in Light of the Second Sub-Hypothesis (Requirements and Implementation of the Intranet and Organizational Immunity)

The second sub-hypothesis stated that: “The intranet plays a pivotal role in meeting internal communicative requirements and securing the flow of information within the institution.”

Field results confirmed the material embodiment of this hypothesis: 68.11% of respondents reported having intranet access available from their offices, and 52.17% of them practiced consistent, stable use of this internal network. The study also revealed the entrenchment of this technology within the port enterprise, as 59.43% confirmed that the institution’s connection to the intranet dates back more than 18 years, while 36.23% reported a period of between 15 and 18 years.

Regarding the organizational reasons and motives for using the intranet, the majority attributed this to:

- The ease of obtaining accurate information in a timely manner (26.42%).
- The necessity of achieving continuous interactive communication among employees (22.28%).
- Coping with the expanding scope of work and the multiplicity of port directorates (18.13%).
- Building mechanisms for organizational distinction and excellence (13.48%).

Regarding the link between the intranet and the reinforcement of organizational immunity, 95.65% of the sample (necessary and highly necessary) agreed on the imperative necessity of using the intranet within the institution. In addition, 76.82% of respondents confirmed that this network had contributed significantly to improving and developing the quality of internal communication. The strategic objectives resulting from this use also included: saving time, effort, and material cost (17.70%), achieving seamless electronic connectivity between port directorates and departments (15.98%), and improving administrative performance and upgrading the quality of services provided (15.63%).

Sociologically, these data confirm that the intranet is not merely a closed communicative channel, but constitutes the “internal nervous system” of the Port Enterprise of Skikda. It works to accelerate and refine the exchange of decisions, eliminate bureaucratic rigidity and stagnation, and reduce the intensity of organizational conflicts arising from the distortion of communicative messages. The intranet is thus the key variable that supplies the institution with structural immunity, protecting it from administrative disintegration and enabling it to withstand and continuously adapt internally.

Fourth: Discussion of the General Hypothesis in Light of the Study’s Objectives

The main objective of the study was: “to identify the reality of the use of modern communication technology (electronic management) and its strategic role in building and activating the organizational immunity of the Port Enterprise of Skikda.”

Through the analytical synthesis of the sub-hypotheses and the field results, the general hypothesis of the study is confirmed, as the data showed a statistically and sociologically significant

effect and role of communication technology tools and digital networks in reinforcing organizational immunity.

This is reflected in the following patterns:

1. Adequacy and complementarity of means: The study showed that digital transformation does not mean the total elimination of classical media, as 55.07% of sample members preferred combining electronic and traditional means in their transactions, compared to 39.13% who preferred electronic means exclusively. This methodological hybridity reflects a state of balanced transformation that prevents organizational shocks and reinforces the institution's immunity against negative resistance to change.

2. Efficiency and training support: The results showed that 61.34% of sample members benefited from training sessions and retraining courses to master the devices and networks, which was reflected in 53.63% rating themselves as having a high level of proficiency, and 51.64% reporting that they encountered no technical difficulties during use. This indicator reflects the success of the institution's management in providing the organizational and cognitive requirements for activating electronic management.

In sum, the gradual and rational reliance on modern communication technology (the computer, the intranet, the Internet) at the Port Enterprise of Skikda has enabled it to transition from the slow traditional bureaucratic administrative model to a flexible digital organizational model. This transformation was not limited to digitizing transactions, but contributed directly to enabling the institution to possess an integrated organizational immunity that grants it the capacity to anticipate crises, act swiftly in decision-making, maintain structural stability, and adapt proactively and effectively to changes in the maritime and economic environment.

Conclusion

Electronic management and modern communication technology applications constitute an inevitable reality and a vanguard extension of the structural transformations imposed by the knowledge and network society. These technologies have become the essential gateway to a qualitative shift capable of overcoming bureaucratic rigidity and increasing the efficiency of service-oriented and economic institutions. Within this framework, this scientific paper set out to explore the dynamics of digital transformation within one of Algeria's vital economic facilities — the Port Enterprise of the Wilaya of Skikda.

The study set out to answer the following central question:

- How do modern communication technology tools (electronic management in its network dimensions) contribute to enhancing the organizational immunity of the Port Enterprise of Skikda?

The field treatment was confined to testing the general hypothesis positing a statistically significant effect and role of communication technology tools and digital networks in building and activating organizational immunity within the port enterprise, specifically through its graduated network dimensions (the computer, the intranet, the Internet, and the extranet).

The general results of the study showed the wide and actual use of digital communication tools within the Port Enterprise of Skikda, with the data confirming that the computer represents the first technical foundation in administrative transactions, followed by the intranet supporting internal information flow, then the Internet oriented toward interaction with the external environment, leading

up to the incipient formation of advanced interactive applications (the extranet). This digital progression has contributed to shifting the institution from the slow traditional administrative model to a flexible digital organizational model possessing structural and responsive organizational immunity, enabling it to adapt proactively to change, reduce the intensity of operational shocks, manage crises, and upgrade the quality of port services.

The scientific contribution and knowledge addition of this study are manifested in offering a contemporary sociological-communicative approach that moves the literature on electronic management beyond the narrow scope of technical or procedural evaluation, situating it within the frameworks of “organizational sociology and organizational immunity.” This study thus provides an explanatory model clarifying how digital networks and media become defensive mechanisms that redraw power relations and ensure the continuity of regulation and rapid response within sensitive economic institutions in Algeria.

Despite the achievement of the study’s objectives, the fieldwork encountered certain difficulties and obstacles, mainly the reticence of some respondents and their reluctance to disclose certain organizational data, in addition to disruptions and unforeseen absences and the fast pace of the port work environment — all of which resulted in the retrieval of 69 valid questionnaires for analysis out of 85 distributed.

In light of these field findings and theoretical perspectives, the study formulates the following set of policy recommendations:

1. Upgrading the network infrastructure (activating the extranet): Moving beyond limiting network use to the internal scope (intranet), and strategically expanding the activation of the extranet to connect the port enterprise with the chain of economic and customs operators, thereby reinforcing the comprehensive organizational immunity of supply chains.
2. Investing in human capital and deepening training: Continuing to provide specialized training and retraining courses in cybersecurity and information safety for executives and workers, to raise their awareness of digital culture and reduce organizational resistance to change.
3. Rationalizing digital transformation (the hybrid model): Maintaining the procedural balance between digital transactions and field operational media, to ensure workflow flexibility without causing organizational shocks that affect the fluidity of port services.
4. Activating video conferencing and meetings: Making maximum use of intranet applications and interactive platforms to reduce time and material costs, and accelerate decision-making mechanisms among the various directorates and departments.

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