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THE ROLE OF TECHNOLOGY IN INSTİTUTİONAL TRANSFORMATION: A THEORETİCAL FRAMEWORK PROPOSAL BASED ON A CASE STUDY

KURUMSAL DÖNÜŞÜMDE TEKNOLOJİNİN ROLÜ: BİR VAKA ÇALIŞMASINA DAYALI TEORİK BİR ÇERÇEVE ÖNERİSİ

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Abstract

This paper aims to propose a theoretical framework that highlights the institutional transformative capacities of technology. It seeks to move beyond the traditional dichotomy that confines technology to either a deterministic or a voluntarist perspective. These opposing views fail to grasp the organizational transformations driven by technology. In the era of ICTs, where technology becomes increasingly invisible yet profoundly impactful, adopting a paradigm capable of addressing this organizational complexity is essential. The constructivist paradigm provides a relevant framework for conceptualizing technology as a social construct with a dual dimension—both structured and structuring. The case study, focused on a water management entity, served as the empirical basis for developing this theoretical framework. By leveraging the structured and structuring dimensions of technology, this framework highlights its institutional transformative capacities while clarifying the origins of institutional arrangements. The findings contribute to a deeper understanding of technology as a driver of institutional transformation within organizations, emphasizing its dual role as both a product and a catalyst of institutional dynamics.

Anahtar Kelimeler: Kurumsal Dönüşüm Teknoloji, Yapılandırmacılık, Yapılandırma Teorisi, Kurumsallaşma, Su Sektörü

JEL Kodları: C44, M10, M13

Öz

Bu makale, teknolojinin kurumsal dönüştürücü kapasitelerini vurgulayan bir teorik çerçeve önermeyi amaçlamaktadır. Teknolojiyi deterministik veya voluntarist bir bakış açısıyla sınırlayan geleneksel ikiliğin ötesine geçmeyi amaçlamaktadır. Bu karşıt görüşler, teknoloji tarafından yönlendirilen kurumsal dönüşümleri kavramakta başarısız olmaktadır. Teknolojinin giderek daha görünmez hale geldiği ancak derin bir şekilde etkili olduğu BİT çağında, bu kurumsal karmaşıklığı ele alabilecek bir paradigmayı benimsemek esastır. Yapılandırmacı paradigma, teknolojiyi hem yapılandırılmış hem de yapılandıran ikili bir boyuta sahip sosyal bir yapı olarak kavramsallaştırmak için ilgili bir çerçeve sağlar. Bir su yönetimi kuruluşuna odaklanan vaka çalışması, bu teorik çerçeveyi geliştirmek için ampirik bir temel görevi görmüştür. Teknolojinin yapılandırılmış ve yapılandıran boyutlarından yararlanarak, bu çerçeve kurumsal düzenlemelerin kökenlerini açıklığa kavuştururken kurumsal dönüştürücü kapasitelerini vurgulamaktadır. Bulgular, teknolojiyi hem bir ürün hem de kurumsal dinamiklerin bir katalizörü olarak ikili rolünü vurgulayarak, kuruluşlar içinde kurumsal dönüşümün bir itici gücü olarak daha derin bir anlayışa katkıda bulunmaktadır.

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JEL Codes: C44, M10, M13

1. INTRODUCTION

The potable water sector in Algeria has undergone a significant reorganization, marked by the creation of new entities in the wilayas of Algiers, Oran, Constantine, and Annaba. This study focuses on the specific experience of Oran, conducted in partnership with the Spanish company Agbar under a delegated management contract covering the period from 2008 to 2013. This collaboration led to the emergence of the Société de l'Eau et de l'Assainissement d'Oran (SEOR), an entity that benefited from an ambitious modernization program, largely supported by the integration of innovative technological systems. The resulting organizational transformation reflects a complex interplay between organizational structures and new technologies.

This observation prompted a theoretical exploration aimed at understanding and explicating this organizational complexity. This article seeks to clarify the interaction between organization and technology, emphasizing the institutionalizing capabilities of technology within this context. We begin by precisely defining the concept of technology, often used interchangeably with other concepts.

The theoretical analysis starts by delineating the dominant approaches in the field of organizational theories. Historically, the debate around technology in organizations has oscillated between two opposing perspectives: technological determinism and voluntarism. Determinism, primarily associated with contingency theory (Woodward, 1965; Perrow, 1967), views organization as a product of technological conditions. In contrast, voluntarism, stemming from interactionism (Trist et al., 1963), considers technology as a modifiable variable in the structuring of production activities.

These antithetical perspectives find reconciliation in Anthony Giddens' structuration theory (1976, 1984). This theory explains how individuals' daily actions simultaneously contribute to the creation and perpetuation of institutional rules. The dialectic between technology and organization is thus enriched through the mediation of technology, as demonstrated by Orlikowski's model (1992, 2000), which is adopted here as the primary analytical framework for understanding the organizational complexity generated by the diffusion of technologies within companies.

To illustrate this theoretical approach, we revisit a case study on the organizational transformation of SEOR. Interviews conducted reveal a profound interplay between technological systems and organizational structures (Nait Bahloul, 2017), resulting in a complex organizational reality that requires deep ontological reflection. We thus draw on the sociology of knowledge by Berger and Luckmann (1966) as well as J. Searle's (1997) approach to grasp this complexity.

The institutionalizing capacities of technology are highlighted through the processes of reification and legitimation described by Berger and Luckmann (1966) and Tolbert and Zucker (1996), which generate a highly constraining intrinsic reality. We also seek to demystify the origin of the institutional properties embedded in technology, addressing a gap in Orlikowski's model (1992). The neo-institutional theory, particularly the works of DiMaggio and Powell (1983) and Meyer and Rowan (1977), argues that the adoption of organizational models and management solutions reflects a tendency for organizations to conform to their institutional environment. The isomorphism mechanism thus connects abstract institutional properties to the technological systems of the organization. In summary, this article aims to shed light on the essential role of technology in constructing organizational reality, with a particular focus on its impact on institutional transformation processes.

The choice of SEOR as a case study is justified by its status as one of the rare successful organizational transformation experiences through ICTs in Algeria, providing a valuable opportunity to analyze this phenomenon. The case study facilitated direct interaction with the actors who experienced this transformation process while exploring the complex organizational reality that emerged from the integration of new technological systems.

Through concrete observations, we identified several significant elements:

- The constraining and structuring nature of technological systems: Organizational actors confirm that these new tools exert a strong influence, transforming both practices and behaviors.

- The transformation of managerial and operational staff: This profound change was made possible through intensive training initiatives, coaching led by Spanish experts, and active engagement in the implementation of new technological solutions.
- The institutional origin of technological systems: These solutions align with institutional isomorphism dynamics, manifesting in three forms: coercive, mimetic, and normative.
- The decentralized organizational configuration facilitated by technological solutions.

These findings highlight the complex interplay between institutional constraints and organizational dynamics, revealing the central role of technology in institutional transformation. The discussion begins with a review of the literature.

2. LITERATURE REVIEW

2.1. Clarifying the Concept of Technology

The notion of technology is far from simple to define precisely, given its vast scope and diverse applications. Jacques Ellul (1964) offers a broad definition, describing it as a "discourse on technique." He further specifies that technique refers to "the entire set of rationally developed methods that possess absolute efficiency (for a given stage of development) in every field of human activity" (Ellul, 1964, p. xxv). In the field of organizational theory, early research primarily focused on technology as a material artifact (Woodward, 1965; Perrow, 1967, 1983). However, other perspectives have expanded this conception by incorporating the immaterial aspect of technology. Castells (1996) highlights that "technology refers to sets of scientific or empirical knowledge that enable the design and deployment of technical means in specific organizational and social contexts, thus integrating software, know-how, and organizational methods" (Castells, 1996, p. 76). In terms of methodology, "technology is a way of understanding and interacting with the world" (Heidegger, 1977, p. 5).

With the rise of information and communication technologies (ICTs), technology has transcended the confines of production spaces, spreading into almost every department within an organization while becoming increasingly imperceptible (Berry, 1983). This diffusion has been accompanied by the tertiarization of the economy and an expansive dematerialization of activities, making ICTs crucial in the organization of activities. ICTs can be defined as "the set of technologies that enable the capture, verification, storage, retrieval, transmission, and reception of information in electronic format" (Laudon & Laudon, 2018, p. 10).

However, it is essential to distinguish ICTs from other related phenomena, such as digitization and digitalization, which can cause confusion. "While digitization is the technical process of converting analog data into digital data, digitalization is described as the integration of these digital technologies into all aspects of human society, thereby influencing social and economic structures" (Brennen & Kreiss, 2016). More specifically, "digitalization is the process by which businesses integrate digital technologies, leading to profound transformations in their operations, organizational structure, and strategy. It goes beyond the mere adoption of technologies, encompassing a reconfiguration of business processes to improve efficiency and foster innovation" (Westerman, Bonnet, & McAfee, 2014).

Digitalization likely represents the most advanced form of the systemic use of technology in various aspects of an organization. This concept closely aligns with the phenomenon observed at SEOR. The workspace becomes a genuine digital infrastructure, whose presence, although often invisible, "manifests when it deteriorates" (Star & Ruhleder, 1996).

2.2. Technology and Organization: Between Determinism and Voluntarism

The organization of the firm has long been interpreted through the lens of external forces of contingency, with a particular focus on the determining role of technology. Joan Woodward (1965) notably established a significant correlation between production processes and the organizational characteristics of the firms she studied. In the case of SEOR, a company operating a continuous process, its organizational structures seem to conform to the ideal type described by Woodward (1965). However, this organizational perspective, focused on formal aspects, tends to dissociate the organization from technology and is rooted in a naturalistic paradigm that subordinates the organization to external forces while neglecting the influence of actors.

Perrow (1984) advocated for a more holistic approach, integrating technological design, the engineering practices of actors, and organizational structures. According to Perrow, organizational structures should reflect the inherent technological complexity of each organization, without explicitly addressing the constructed nature of technology.

Functionalism has given rise to the idea of organizational configuration, a systemic approach that proposes understanding the organization as a set of interacting components according to contingency factors (Mintzberg, 1978, 1990). This perspective, inspired by Darwinism, reduces organizations to entities that adapt to their environment. While this analysis introduces a certain complexity, it remains anchored in naturalistic reductionism, where the laws of selection inevitably shape organizations while maintaining a rigid separation between technology and organization.

On the side of voluntarist approaches, sociotechnical analysis views technology as an adjustment variable capable of providing optimal economic and social performance (Trist et al., 1963). In this context, leaders adopt technological systems tailored to the needs of production actors. Zuboff (1988) shares this view, perceiving technology as a tool enabling leaders to create either spaces of autonomy and empowerment or restrictive work environments.

However, this instrumental view is nuanced by the strategic analysis of Crozier and Friedberg (1977), who perceive technology not as a constraint in itself but as a social construct emerging from the strategies of actors within a complex network of organizational games. According to them, technology exerts constraints only through the interactions between actors. The main limitation of this approach lies in its inability to fully grasp the complexity of the relationship between actors and technology. To overcome these limitations, it is essential to adopt approaches that consider the organizational framework as a social construct, a paradigm capable of integrating actors as fundamental elements of organizational and technological systems.

2.3. Early Constructivist Approaches

A new wave of approaches moves away from viewing technology merely as a simple artifact, attributing it instead with a dialectical dimension. Socioconstructivist contributions examine how shared interpretations around a given technology emerge and influence not only its development but also the interaction it generates (Bijker, 1987; Bijker, Hughes, & Pinch, 1987). While this body of research is valuable for understanding how the meanings of a technology are formed and sustained, it often tends to downplay the material and structural aspects of technological interaction. In a similar vein, Barley (1986, 1990) offers a perspective that considers technology as a trigger for change.

In Barley's framework (1986, 1990), technology is perceived not as a direct material cause, but as a material trigger that initiates specific social dynamics, leading to both anticipated and unanticipated structural consequences, such as increased decentralization. Technology is thus understood as a social object, whose meaning is determined by the context in which it is used. Although Barley acknowledges that some characteristics of technology are socially constructed, he does not accept that the technology itself can be modified during its use. Our view of technology is both constructivist and dialectical, bringing together the contradictions inherent in deterministic and voluntarist approaches.

Reynaud (1988, 1997) introduces a dialectic within reasoning that echoes the work of Crozier and Friedberg (1977). He equates collective action to social regulation, whether it be control or autonomy (Reynaud, 1988), thereby generating organizational rules. These rules then become constraints on the actions from which they originate. In a Durkheimian sense, these constraints possess an external reality that imposes itself on actors (Durkheim, 1967, p. 35). The reasoning becomes constructivist when organizational rules do not preexist the activities of actors but result from them (De Fornel & Lemieux, 2007).

This approach highlights two inclusive dimensions. On the one hand, social regulation theory conceptualizes the organization as a regulatory process that produces rules with political and semantic dimensions. On the other hand, it proposes a new orientation inherent to institutional rules generated by action and for action.

Social regulation theory thus represents a decisive step toward a more inclusive framework. Although its reasoning may seem rudimentary, the regulations of control and autonomy remain crucial issues in the implementation of new technological solutions. They express the leaders' desire to subject the agents' activities to controls that limit their autonomy. In response, these agents develop autonomous regulatory capacities to counteract the control regulations imposed upon them. While social regulation theory sheds light on the issues surrounding new technological systems, it does not fully explain the relationship between organization and technology.

As Orlikowski (1992) notes, "while researchers have focused on deconstruction to identify the limits imposed by overly deterministic or unduly voluntarist perspectives, they have not engaged in the equally important task of reconstruction" (Orlikowski, 1992, p. 402). What is still lacking is a new conceptualization of technology and its relationship with organizations, allowing us to move beyond critique and establish another conceptual basis that accounts for the structural nature of technology.

3. METHODOLOGY, THEORETICAL AND CONCEPTUAL FRAMEWORK

3.1. Methodology

In a constructivist perspective, the development of a theoretical framework requires an empirical context conducive to in-depth questioning, especially as our research problem involves understanding a complex organizational reality. This primarily theoretical approach is based on a rigorous analysis of qualitative data from various sources, culminating in the proposed theoretical framework discussed in the dedicated section.

The case study focused on SEOR, a state-owned joint-stock company (Spa) responsible for water and sanitation management in the city of Oran. This case represents a valuable opportunity due to the profound organizational transformations the entity has undergone since its establishment in 2008, characterized by extensive adoption of new technological systems. These transformations have produced a complex organizational reality, radically contrasting with the company's initial state.

The investigation was conducted in 2013 and covered the period from 2008 to 2012, during which SEOR operated under a delegated management contract with its Spanish partner, AGBAR. This partnership included provisions for the transfer of technologies and management practices.

Data were collected through semi-structured and in-depth interviews with operational and senior managers. In total, 10 managers were interviewed, with each interview lasting an average of 1.5 hours. Additionally, comprehensive documentation, mainly composed of management reports, was made available for analysis. A specific investigation within one department also included a collective interview with the entire staff. Finally, participant observations were conducted in two different structures.

The analysis of data from interviews, documentation, and observations provided an in-depth understanding of SEOR's organizational transformations. These insights guided the selection of an appropriate theoretical framework and contributed to the development of a new framework, shedding light on the dynamics of institutional transformation within the company. The components of this theoretical framework are presented in the following section.

3.2. Anthony Giddens' Structuration Theory (1976, 1984)

Technology, as a social construct, can be explored and applied through the lens of structuration theory, as demonstrated by various studies (Bouchikhi, 1990; Orlikowski, 1992, 2000; Barley, 1986; DeSanctis & Poole, 1994; Vacheux, 1998; Autissier & Le Goff, 2000). This theory transcends a mere conceptual framework by offering a new and institutionalist perspective, revealing how individuals' daily actions contribute to the creation and perpetuation of institutional rules. Moreover, it proposes a holistic approach that integrates political, semantic, and legitimacy dimensions.

Structuration theory is inclusive, combining both interactionist and structuralist perspectives. It illustrates how the structural properties of social systems are both created and maintained by individuals' actions, a process articulated around the central concept of structural duality. This concept posits that the formation of agents and structures is not dissociated but interdependent: "structural properties are simultaneously the means and the outcomes of the practices they regulate discursively" (Giddens, 1984, p. 75). Concerning technology, particularly in advanced systems, it incorporates inherent rules that influence human activities and behaviors, thereby challenging reductive views that consider it merely an abstract determinant of organization. As a social construct, technology thus manifests a role that is both structured and structuring, in connection with structural duality.

Mohrman and Lawler (1984) emphasize that, because technologies are socially constructed, they can also be reconstructed. Structuration theory explains this constructed nature through an analysis organized around three levels:

1. **The level of agency,** where actors engage in their social activities.
2. **The higher, abstract level,** which comprises the institutional properties of the system.
3. **The intermediate level,** composed of schemas that mediate between collective action and structural properties.

These levels are interconnected by structures of domination, signification, and legitimation, which shape social interactions by influencing meaning, power, and norms within organizations. Technologies function as means of exercising power and reflect resource asymmetries, which, when exploited, can reinforce or transform existing structures of domination. From the perspective of agency, norms govern legitimate behaviors and are guided by normative sanctions. These norms constitute, from an institutional perspective, structures of legitimation that maintain moral order through cultural and traditional practices.

The relevance of structuration theory lies in its ability to explain the structural nature of technology, which manifests through its mediating role in organizational dynamics. Structuration theory frees itself from extreme views by assimilating technology as neither an external factor nor merely an element subject to agents' actions. This mediating nature is illustrated by Orlikowski's model (1992), adapted from Giddens' generic framework (1984):

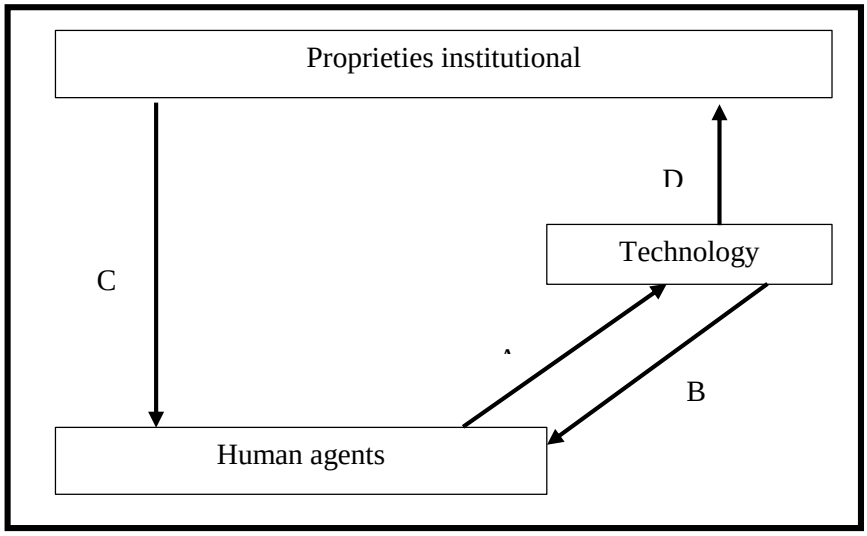

Fig. 1. The structural duality of technology

Source: Orlikowski, 1992, p. 410.

The model highlights three interacting elements:

1. **Human Agents**: These include technology designers, users, and decision-makers, who play an active role in the creation and manipulation of technology.
2. **Technology**: Composed of both material artifacts and immaterial systems, technology facilitates task execution in professional environments.
3. **Institutional Properties of Organizations**: These encompass dimensions such as control mechanisms, standard operating procedures, division of labor, and expertise. They also include external influences like government regulations, supplier strategies, professional norms, technological knowledge, and socio-economic conditions.

At the core of this model, technology serves as a medium between human agents and the institutional properties of the system. The interactions between these elements are illustrated by four dynamic relationships:

- **Arrow A**: Technology is the product of human action, existing only through human creation and requiring continuous maintenance and adaptation.
- **Arrow B**: As a medium for human action, technology mediates workers' activities during its use.
- **Arrow C**: Human agents, in interacting with technology, are influenced by institutional properties, drawing on pre-existing knowledge, resources, and norms.
- **Arrow D**: The use of technology by humans can reinforce or transform an organization's institutional properties.

Agents possess interpretive flexibility (Pinch & Bijker, 1987) in the design and use of technology. In the design phase, they incorporate interpretive schemas, facilities, and norms that reflect knowledge of automated work. In

the usage phase, they appropriate technology by assigning shared meanings to it, thereby influencing their way of working (Weick, 1967, 1995).

Stable recursivity, without the active deployment of interpretive capacities, tends to maintain existing institutional structures. Conversely, activating these capacities can lead to significant changes in institutional properties. Barley's comparative studies (1986, 1990) in two radiology departments equipped with the same technology illustrate how different institutional properties can lead to distinct organizational structuring.

Among the various contributions to structuration theory and technology, Orlikowski's (1992) stands out for its substantial contribution by making technology both a product of human action, a medium that mediates social activity, and a repository of institutional properties. In this model, technology is both influenced by and influential on the different components of this dynamic that transcends the traditional organizational framework. A fundamental conclusion emerges: the institutionalizing capacity of technology. This realization invites us to explore ontological approaches capable of accounting for the intertwining of organization and technology.

3.3. The Institutionalizing Capacity of Technology

To what extent does technology contribute to the institutionalization of organizations**?** This is the question we aim to address. In the sociology of knowledge developed by Berger and Luckmann (1966), institutional rules are defined through a dialectic that opposes their internalized dimension within actors to their reified, external dimension. These rules shape recursive activity as they become integrated into the habitus of individuals (Bourdieu, 1991). Reification gives these rules an external and autonomous existence, a process of naturalization that transforms them into non-human and alien facts, even to those who created them (Berger & Luckmann, 1966, p. 167).

In his explanation of what constitutes an institutional fact, J. Searle (1997) highlights the role of collective beliefs and the recursive practices of individuals. In other words, social facts are formed and transformed through a dialectic between collective beliefs and concrete practices, giving them both a cognitive and practical dimension. Ontological approaches illustrate the formation of institutional facts through a dual dialectic that reflects a social construction where reification and internalization, on the one hand, and interactions between collective beliefs and competent practices, on the other hand, converge.

Complex technological systems embody an intrinsic reality that constitutes a workspace and collaboration environment. This intrinsic reality is defined by embedded operational rules, as well as control norms and information related to agents' activities. Technological applications also serve as a means of distributing work, allocating resources, and assigning power. In this sense, technologies incorporate a substantial portion of the institution's institutional properties. Numerous constraints are reified within technological solutions, conditioning actors' activities at various levels. This intrinsic reality is difficult to manipulate, especially when it comes to control information. Conversely, when management systems are not embedded within ICTs, agents' room for maneuver can be significant.

The intrinsic reality refers to structural properties, such as the distribution of work, assignment of prerogatives, organizational procedures, control norms, communication modes, etc.

The institutionalization of social reality in general, and organizational reality in particular, follows the process of habituation, typification, objectification, and finally legitimation (Berger & Luckmann, 1966). Tolbert and Zucker (1996) propose a similar framework, but without the legitimation phase. Without technology, the formation of a new social reality is a lengthy process, at the end of which organizational rules and operational norms acquire an external reality that imposes itself on actors. During this process, actors can influence the course of events through their interpretive capacity. However, when activities are governed by technology, this interpretive flexibility narrows, and the institutionalization process accelerates due to technology's ability to quickly establish an intrinsic, reified, and legitimized reality. In this sense, technology acts as an accelerator in the formation of institutional reality.

The transformation of organizations occurs through changes in their institutional properties. The question that arises is, where do these institutional properties originate? This question invites us to move beyond internal logics and explain organizational dynamics through their institutional environment.

3.4. The Origin of Organizational Institutional Properties

The first response is provided by Meyer and Rowan (1977), who argue that it is institutionalized myths that influence organizational decisions in companies. Decision-makers are conditioned by the institutional environment, which provides them with management solutions not because of their effectiveness, but because they offer a boost

in legitimacy. It is the institutional environment that shapes the organization of the company more than the competitive environment. Companies tend to conform to this environment to gain legitimacy, which in turn helps them access the resources they seek and meet the expectations of regulatory bodies. C. Midler (1986) provides several examples of management solutions sold by consulting firms, whose effectiveness is unproven, yet they spread rapidly. Organizational transformations often reflect these myths, beliefs in the superiority of a particular organizational device, not for efficiency gains but to enhance legitimacy, especially in the eyes of capital providers and regulatory bodies.

Neo-institutional theory explains the alignment of organizations with their institutional environment through the mechanism of isomorphism (Nait Bahloul and Kansab, 2024). DiMaggio and Powell (1983) distinguish three types of isomorphism: coercive, mimetic, and normative. Coercive isomorphism refers to specific regulations in the water sector, particularly in its commercial aspect, which align operators with the same standards and practices. Normative isomorphism is inherent in standardized competencies in the field, a role fulfilled by the numerous specialized training centers in Algeria. Mimetic isomorphism, on the other hand, involves the replication of similar management solutions and practices by operators. This form of isomorphism was intensified by the partnership with Agbar, whose management solutions were transferred from the multinational. The experience of delegated management with an international operator is itself a process of transferring organizational models developed in a capitalist economy to an Algerian context, which is transitioning toward a market economy. Myths are transferred and sold to Algerian decision-makers, reflecting the capitalist spirit that has fuelled the expansion of bureaucracy and the dissemination of management models in the potable water distribution sector.

The partnership with the Spanish company is seen as a major phase of change at SEOR. These changes have been both constrained and facilitated by technology. The new institutional properties can be summarized as follows:

- The multi-divisional organization ("M-form") of the five operating zones.
- The new quality management standards, largely derived from Algerian regulations, incorporated into commercial management applications.
- New provisions in competency management, also facilitated by a new application (SGP).
- The digitalized geographic information system, which facilitates the control of distribution networks.
- New control rules for AEP activities, also incorporated into new applications.

The company's annual report highlights nearly 160 management indicators, all generated by the new technological systems. The changes at the Oran operator can be seen through the lens of isomorphism, which enabled the entity to conform to both local and international institutional environments. We observe the paradox highlighted by DiMaggio and Powell (1983): in their attempts to adapt to their institutional environment, organizations end up resembling each other.

3.5. The Proposed Theoretical Framework

The overall theoretical framework presented in Figure 2 is composed of five key elements. At the core of this framework, technology occupies a central position, integrating institutional properties through the process of isomorphism. These institutional properties form the very essence of organizational reality, exerting a particular constraint on user agents. Actors engage with technology by utilizing schemas related to resources, norms, and interpretations, the repetition of which ensures the reproduction of structures of power, legitimation, and meaning.

The figure illustrates the essence of structuration theory, which posits that all social order emerges from a dialectic between the activities of agents and structural elements. The mediation of this generic relationship by technology has been highlighted by numerous studies, particularly those by Orlikowski (1992), who identifies three categories of actors: technology users, designers, and managers. In the context of utilizing technological systems, the constraint exerted by technology weighs more heavily on the users. The figure below highlights the origin of institutional properties, which emanate from the environment and are incorporated into technology through mechanisms of isomorphism.

The recurrent use of technology leads to the continuous reproduction of organizational structures. The role of technology is thus more than just significant; it plays a central role in the process of organizational institutionalization. Technology contributes significantly to consolidating and accelerating the processes of

reification and legitimation of institutional properties. Through its actions, technology actively participates in the structuring of the organization by transforming norms and practices into enduring institutional realities.

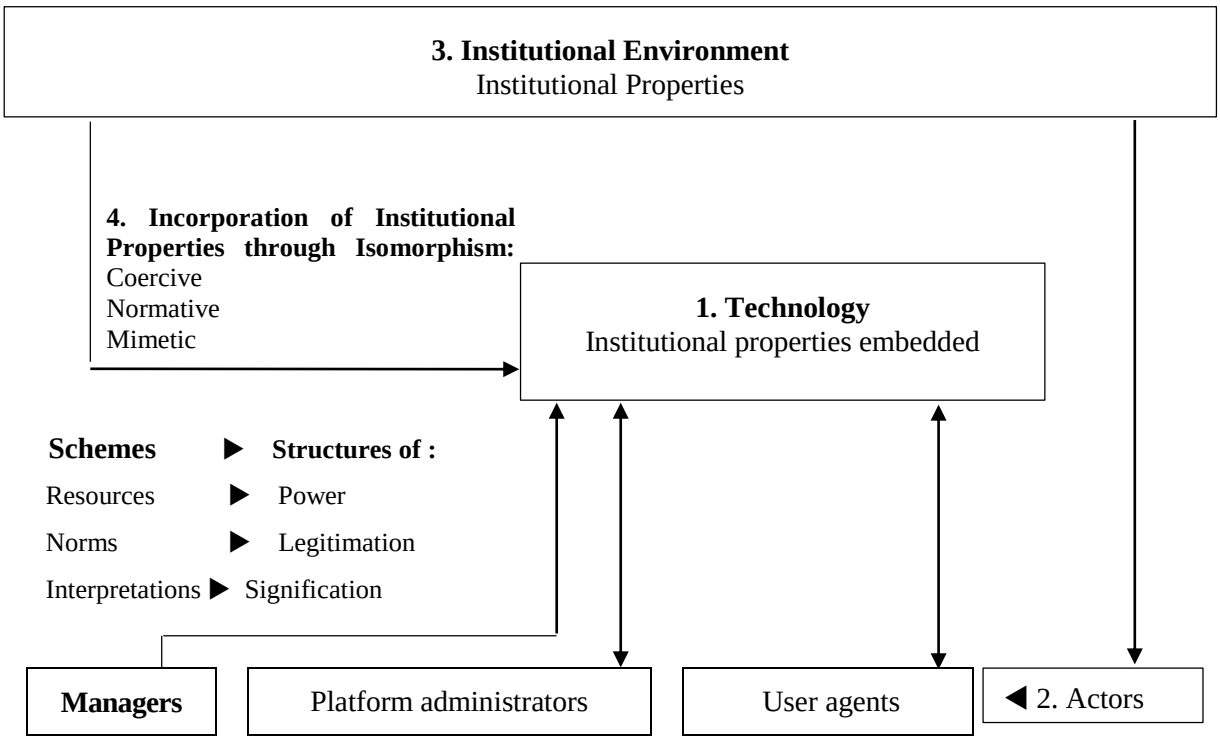

Fig. 2. Central Role of Technology in Structuration

Source: Developed by ourselves

4. DISCUSSION

Based on empirical observations within SEOR, where a major organizational transformation was achieved with the support of technology, this study sought to clarify the central role of technology in shaping this new organizational reality.

Technological Diffusion and Intrinsic Reality : The dissemination of technological solutions focused on strategic functions such as commercial management, water management, competency management, and the design office. These technological solutions incorporated an intrinsic reality partially derived from Algerian regulatory requirements governing the water sector. The norms and operational rules embedded within these systems impose constraints on the company's personnel. This highlights the mediating nature of technology, acting as a bridge between institutional structures and organizational actors.

Organizational Transformations and Socialization of Managers: The changes were particularly noticeable among the managers interviewed, who reported experiencing a genuine personal and professional transformation. This process of socialization was facilitated through training programs, coaching, and their direct involvement in the implementation of new management systems. The emergence of new actors with skills and attitudes adapted to technological demands was another key outcome of this transformation.

Institutional Origins of Transformations (Mechanisms of Isomorphism): The observed transformations find their origins in institutional isomorphism mechanisms (DiMaggio & Powell, 1983):

- **Coercive isomorphism**: This mechanism stems from stringent regulations governing water distribution, particularly concerning quality, operational norms, and pricing.

- **Normative isomorphism**: This refers to the standardization of competencies in the sector, influenced by international and regional institutions specializing in water management.
- **Mimetic isomorphism**: This mechanism is evident in the replication of proven solutions within the sector, disseminated by multinationals such as AGBAR, which played a key role in transferring its management practices to SEOR.

The Enabling Role of Technology in Organizational Structuring: Technology has proven to be an essential catalyst for this institutional transformation by creating an intrinsic reality that applies to all categories of personnel, particularly those involved in operations. For instance, management reports include more than 160 control indicators covering various domains of the company.

At the operational level, the organization has been structured into nine local management units in Oran, each with broad prerogatives. A dynamic of competition has been established between these entities through a performance ranking system generated by new technological tools. This system, which emphasizes transparency and efficiency, reflects the enabling nature of technology in this reorganization.

Theoretical Contribution and Conceptual Framework Enhancement: The case study provided a context for interacting with a complex organizational reality, enabling the refinement of the theoretical model. This model is grounded in Giddens' structuration theory (1984) and enriched by Orlikowski's work (1992), which examines the technological mediation of organizational dynamics.

Three key points can be highlighted:

1. The capacity of technology to structure interactions between actors and structures.
2. The integration of isomorphism mechanisms as vectors of institutional conformity.
3. The central role of technology as a driver of institutional transformation, combining enabling, structuring, and legitimizing effects.

In summary, we have sought to demonstrate that technology transcends its operational role to become a key structuring actor in institutional dynamics. Broader theoretical considerations are discussed in the conclusion.

5. CONCLUSION

To address our research question, it was essential to clarify the interconnection between organization and technology, which now forms a unified organizational reality, sometimes referred to as "organizational technology." Rather than adopting a purely instrumental and operational perspective, our analysis attributes a central role to technology in the structuring of organizations. This role unfolds through internal and external mechanisms that connect organizational systems to their institutional environment, and these mechanisms have been precisely identified and articulated within our model.

The structuring role of technology, initially suggested by Barley (1986, 1990), is further developed here. Although Barley identified technology as a trigger for change, he did not explain the underlying mechanisms. Our work shows that this capacity of technology stems from the intrinsic reality it integrates—a reality that constrains organizational actors, including designers. This constraint operates due to the dual nature of this reality, both reified and legitimate, as it originates from the authority of those empowered to establish the rules and norms of operation (Weber, 1968). The constraining force of this technology is explained by the process of institutionalization it accelerates, thereby acting as a powerful engine in the reification of organizational properties.

Our analysis has highlighted the internal institutional mechanisms inherent in technology. Moreover, organizations are connected to their external institutional environment through mechanisms of isomorphism (DiMaggio & Powell, 1983), which convey institutionalized myths (Meyer & Rowan, 1977) as well as management solutions and practices. The structuring of organizations, from this perspective, is explained by their adaptation to the pressures of the institutional environment in order to gain legitimacy with regulatory bodies and capital providers. The reorganization of SEOR illustrates this dynamic, carried out in a ceremonial logic under the impetus of the Spanish partner to gain the approval of the Algerian authorities. Technology plays a pivotal role, not only by linking organizational systems to the institutional environment through isomorphic mechanisms but also by internalizing institutional properties and transforming them into a reality that is both constraining and legitimate.

The structural duality of technology inherently links it to different organizational actors, mediating their activities (Giddens, 1984; Orlikowski, 1992). This connection represents the third aspect of the central role of

technology. Although subject to certain constraints, internal actors actively contribute to the production and reproduction of organizational structures. Managers, as initiators of technological solutions adapted to the specific needs of the organization, play a key role in regulation and control. Digital platform managers, while less influential, benefit from a certain degree of interpretative flexibility. As for operations agents and managers, they actively participate in the recursive use of technology, which allows for the continuous production and reproduction of the institutional properties embedded in technology.

Technology also functions as a vehicle for the dissemination of models and management solutions derived from the institutional environment. Organizational models and emerging practices, often institutionalized as myths (Meyer & Rowan, 1977), are adopted by managers to increase their legitimacy with regulatory and funding bodies. These myths, such as quality management, various certifications, as well as specific management techniques (such as water management in the case of SEOR), are integrated into information systems. In some cases, these systems directly implement standardized operational solutions, thereby making technology a tool for implementing institutional myths and a powerful driver of organizational transformation.

The central idea of the proposed model is to broaden our understanding of the role of technology in modern organizational transformations. This model is at the intersection of the constructivist approach to organization, neo-institutional theory, and ontological approaches, allowing us to move beyond reductive explanations that focus on a single explanatory factor.

However, the proposed model will require further attempts at refutation, particularly in its external institutional dimension. Future perspectives should be explored to test and strengthen this model, especially to better understand the role of digital technologies and, above all, artificial intelligence in the institutionalization of organizations.

This article calls for a rethinking of how technology is perceived within organizations. It is no longer merely a material artifact or a simple tool for manipulation and control. Managers must fully recognize the scope of technological systems in the enterprise. These systems often incorporate a significant portion, if not the entirety, of the organizational framework, thereby becoming an integral organizational reality. This reality profoundly influences behaviors and attitudes due to its dual nature: enabling and constraining.

All organizational transformation processes now rely on technology, which embodies an accelerated institutionalization mechanism. In this sense, it serves as a crucial lever for the institutionalization of organizations. Leaders must thoroughly understand this institutional dimension: its origins, its methods of establishment, and the reasons for its constraining nature. Identifying and analyzing the institutional issues inherent in technological systems—whether rooted in myths or rational logics—is essential for optimizing managerial practices and decision-making concerning the selection of technological solutions.

Ultimately, a better understanding of these institutional dynamics will not only enhance the effectiveness of implemented technologies but also strengthen their contribution to the structuring and transformation of organizations.

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