Revista científica Portal de la Ciencia

ISSN: 2953-6502
Fecha de presentación: 07/06/2026
Fecha de aceptación: 11/07/2026
Fecha de publicación: 01/08/2026

Mohamed Mammeri
E-mail: mammeri30med@gmail.com
Orcid: https://orcid.org/0009-0008-6645-9435

Ahmed Zabana University. Relizane, Algeria

Suggested citation (APA, seventh edition)

Mammeri, M. (2026). Fayol in the age of algorithms: classical administrative principles and the digital transformation of public administration. *Portal de la Ciencia*, 7(S1), 405-418, DOI: https://doi.org/10.51247/pdlc.v7iEspecial1.937

==== o ====

Fayol in the age of algorithms: classical administrative principles and the digital transformation of public administration

ABSTRACT

Objective: this reflection article examines whether Henri Fayol's fourteen classical principles of administration, formulated in 1916 for hierarchical, paper-based organizations, remain analytically useful for understanding public administration under digital transformation and algorithmic governance. Methodology: the study combines a critical synthesis of Fayol's original administrative doctrine with contemporary digital-government and algorithmic-bureaucracy scholarship, alongside official United Nations E-Government Development Index (EGDI) statistics for Algeria (2016-2024), treating both bodies of material as primary sources for conceptual analysis rather than for causal statistical testing. Main findings: several Fayol principles — unity of command, scalar chain, centralization, equity — are directly destabilized by algorithmic administration, in which automated systems, rather than named superiors, issue and enforce administrative decisions; other principles, notably division of work and order, are intensified rather than discarded by digitalization. Applications: the argument speaks to public administration, e-government studies, and administrative law, offering practitioners a structured vocabulary for diagnosing which classical administrative safeguards are eroded, preserved, or reinvented by digital transformation. Novelty: rather than treating digitalization as a generic, undifferentiated trend, the article proposes an explicit three-part classification — destabilized, intensified, reinvented — for reading Fayol's individual principles against digital-era administrative mechanisms, illustrated with documented evidence from Algeria's e-government trajectory.

Keywords: Henri Fayol; principles of administration; digital transformation; algorithmic bureaucracy; e-government; public administration.

==== o ====

Fayol en la era de los algoritmos: los principios administrativos clásicos y la transformación digital de la administración pública

RESUMEN

Objetivo: este artículo de reflexión examina si los catorce principios administrativos clásicos de Henri Fayol, formulados en 1916 para organizaciones jerárquicas y basadas en papel,

siguen siendo analíticamente útiles para comprender la administración pública bajo la transformación digital y la gobernanza algorítmica. Metodología: el estudio combina una síntesis crítica de la doctrina administrativa original de Fayol con la literatura contemporánea sobre gobierno digital y burocracia algorítmica, junto con las estadísticas oficiales del Índice de Desarrollo del Gobierno Electrónico (EGDI) de las Naciones Unidas para Argelia (2016-2024), tratando ambos cuerpos de material como fuentes primarias para el análisis conceptual y no para pruebas estadísticas causales. Hallazgos principales: varios principios de Fayol —unidad de mando, cadena escalar, centralización, equidad— son directamente desestabilizados por la administración algorítmica, en la que sistemas automatizados, y no superiores nombrados, emiten y hacen cumplir las decisiones administrativas; otros principios, en particular la división del trabajo y el orden, se intensifican en lugar de descartarse con la digitalización. Aplicaciones: el argumento interesa a la administración pública, los estudios de gobierno electrónico y el derecho administrativo, y ofrece a los profesionales un vocabulario estructurado para diagnosticar qué salvaguardas administrativas clásicas se erosionan, se preservan o se reinventan con la transformación digital. Novedad/originalidad: en lugar de tratar la digitalización como una tendencia genérica e indiferenciada, el artículo propone una clasificación explícita en tres partes —desestabilizado, intensificado, reinventado— para leer los principios individuales de Fayol frente a los mecanismos administrativos de la era digital, ilustrada con evidencia documentada de la trayectoria de gobierno electrónico de Argelia.

Palabras clave: Henri Fayol; principios de administración; transformación digital; burocracia algorítmica; gobierno electrónico; administración pública.

==== o ====

Fayol na era dos algoritmos: princípios administrativos clássicos e a transformação digital da Administração Pública

RESUMO

Objectivo: Este artigo reflexivo examina se os catorze princípios administrativos clássicos de Henri Fayol, formulados em 1916 para as organizações hierárquicas baseadas no papel, continuam a ser analiticamente úteis para a compreensão da administração pública sob a transformação digital e a governação algorítmica. Metodologia: O estudo combina uma síntese crítica da doutrina administrativa original de Fayol com a literatura contemporânea sobre o governo digital e a burocracia algorítmica, juntamente com estatísticas oficiais do Índice de Desenvolvimento do Governo Eletrónico (EGDI) das Nações Unidas para a Argélia (2016–2024), tratando ambos os conjuntos de materiais como fontes primárias para análise conceptual, e não para testes estatísticos causais. Principais conclusões: Vários dos princípios de Fayol — unidade de comando, cadeia escalar, centralização e equidade — são diretamente minados pela gestão algorítmica, na qual os sistemas automatizados, em vez de superiores nomeados, emitem e aplicam decisões administrativas. Outros princípios, particularmente a divisão do trabalho e a ordem, são intensificados em vez de serem descartados com a digitalização. Aplicações: O argumento é relevante para a administração pública, estudos de governo eletrónico e direito administrativo, e fornece aos profissionais um vocabulário estruturado para diagnosticar quais as salvaguardas administrativas clássicas que são erodidas, preservadas ou reinventadas pela transformação digital. Inovação/originalidade: Em vez de tratar a digitalização como uma tendência genérica e indiferenciada, o artigo propõe uma classificação explícita em três partes — desestabilizada, intensificada e reinventada — para interpretar os princípios individuais de Fayol em relação aos mecanismos administrativos da era digital, ilustrada com evidências documentadas da trajetória do governo eletrónico na Argélia.

Palavras-chave: Henri Fayol; princípios da administração; transformação digital; burocracia algorítmica; governo eletrónico; administração pública.

INTRODUCTION

In 1916, Henri Fayol, a French mining engineer who had turned a struggling metallurgical combine profitable, distilled decades of that experience into fourteen principles of administration meant to apply to any organization, public or private (Wren et al., 2002). Unity of command, scalar chain, centralization, equity, esprit de corps: these were working rules tested against an organization run on paper records, face-to-face supervision, and a chain of named superiors each accountable for a defined span of subordinates. A century later, a growing share of public administration instead runs on automated decision systems, algorithmic risk-scoring, and citizen interactions that never pass through a named official at all (Bovens & Zouridis, 2002; Zuiderwijk et al., 2021). This article asks the question that follows: do Fayol's principles still describe how public administration works, or have they been rendered obsolete by the transformation now reshaping the institutions his doctrine helped found?

The question is not merely historical. Fayol's principles remain among the most widely taught frameworks in public administration education, and continue to structure how administrative law conceives of authority, accountability, and hierarchy within the state (Wren et al., 2002). If digital transformation has quietly hollowed out the conditions those principles presuppose — a human superior who gives an order, a subordinate who can contest it, a visible chain connecting the two — then applying Fayol's doctrine without qualification risks describing an administrative world that, in its most digitalized functions, no longer exists. If other principles survive intact or strengthened, the more useful task is distinguishing which parts need reinvention from which remain sound (Fayol, 1949).

This article argues for a differentiated answer rather than a verdict of obsolescence or continuity. Some principles are directly destabilized by algorithmic administration: unity of command breaks down when several automated systems issue conflicting outputs with no single accountable superior to appeal to; the scalar chain is partly bypassed when citizens interact with "system-level bureaucracies" that route decisions through code rather than a supervised hierarchy (Bovens & Zouridis, 2002); equity is placed at new, less visible risk when algorithmic bias scales unfair treatment invisibly, in a way a single biased clerk never could (Zuiderwijk et al., 2021). Other principles are intensified rather than discarded: division of work proceeds further, now splitting tasks between human judgment and automated processing (Ahn & Chen, 2022); order finds its most literal digital-era expression in the data-governance architectures digital transformation demands (Vial, 2019).

Algeria's decade-long digital transformation offers a concrete, documented setting for testing this argument rather than treating "digitalization" as an abstraction. The United Nations E-Government Development Index (EGDI) shows Algeria's score rising steadily from 0.300 in 2016 to 0.596 in 2024 (United Nations Department of Economic and Social Affairs [UN DESA], 2024) — a public administration whose channels of citizen interaction, and increasingly its internal decision architecture, have moved substantially onto digital infrastructure within a single decade.

Three qualifications bound the argument. First, Fayol's principles were never a complete or uncontested account of administration even in 1916; they have long been supplemented by later theory, including Weber's (1978) account of bureaucratic authority and Gulick's (1937) elaboration of executive functions. Second, "digital transformation" is not synonymous with any one technology; the argument concerns the general shift toward automated, system-mediated administration. Third, the Algeria case anchors an otherwise abstract debate in a documented national trajectory; it is not a controlled test of causal claims about

digitalization's effects, nor the article's only intended audience — the argument and the diagnostic method developed below are built to apply to public administrations in developing countries more broadly.

Two methodological clarifications matter before proceeding. The three-way classification used throughout — destabilized, intensified, reinvented — is an explicit analytical criterion, not an independently validated empirical category: a principle is destabilized when digital transformation removes the specific human relationship it presupposes; intensified when its underlying mechanism continues through new technical means; reinvented when its outcome depends on implementation choices rather than being settled by the technology itself. Table 1 and Figure 1 apply this criterion as an interpretive synthesis, not as statistically tested findings. Relatedly, the EGDI measures the maturity of online services, telecommunication infrastructure, and human capital — not administrative authority or accountability directly — so it is used here only to establish that a sustained digital transformation has occurred; the argument about which principles that transformation destabilizes, intensifies, or reinvents rests on the administrative-theory literature reviewed next, not on the index score itself.

The remainder proceeds in two steps. The next section reviews Fayol's doctrine and the digital-government literature that has, largely without reference to Fayol, documented the same transformation from the opposite direction. The following section works through Fayol's fourteen principles, summarized in Table 1 and Figure 1's conceptual model, to argue which are destabilized, intensified, or reinvented, using Figure 2's documentation of Algeria's EGDI trajectory as an empirical anchor. A final section draws conclusions relevant beyond the Algerian case, notes the limits of a synthesis built on secondary sources, and proposes directions for future research.

DEVELOPMENT OF THE TOPIC

Theoretical and Empirical Background

Fayol's administrative doctrine

Fayol distinguished the administrative function — to forecast, organize, command, coordinate, and control — from the technical, commercial, financial, security, and accounting functions he also identified within any enterprise, arguing that administration was itself a distinct, teachable skill rather than an incidental byproduct of technical expertise (Wren et al., 2002). From decades spent running Commentry-Fourchambault-Decazeville, Fayol distilled fourteen principles: division of work, authority and responsibility, discipline, unity of command, unity of direction, subordination of individual interest to the general interest, remuneration, centralization, scalar chain, order, equity, stability of tenure, initiative, and esprit de corps. Fayol had signaled the direction of his thinking well before his 1916 masterwork, first in a paper to the Congrès International des Mines et de la Métallurgie in 1900 and then in a more developed lecture, "Discourse on the General Principles of Administration," delivered at the Société de l'Industrie Minérale's own Silver Jubilee Congress in 1908; Wren et al. (2002) recovered and translated this 1908 address, showing that Fayol presented his principles not as rigid laws but as flexible guides requiring judgment in application — a nuance often lost in later, more mechanical textbook renderings of his doctrine.

Fayol's contemporaries and successors extended rather than replaced this framework. Weber's (1978) analysis of legal-rational bureaucracy, developed independently in Germany, supplied the theoretical account of impersonal, rule-bound authority that complements Fayol's more practice-oriented principles, particularly around discipline, hierarchy, and the depersonalization of administrative decision-making. Gulick's (1937) subsequent elaboration of executive functions — planning, organizing, staffing, directing, coordinating, reporting, and budgeting — refined Fayol's administrative function into a more granular checklist that became foundational to twentieth-century public administration training. None of this later

work, however, anticipated a scenario in which the entity issuing an administrative order might not be a person at all. A critical theoretical counterpoint Fayol, Weber, and Gulick each wrote from inside the administrative project, seeking to make authority and discipline function more effectively; a separate critical tradition asks instead what such mechanisms of authority and discipline do to the people subject to them, and this tradition anticipated several features of algorithmic administration decades before the technology existed. Foucault's (1977) analysis of disciplinary power argued that modern institutions increasingly govern not through visible, personal command — Fayol's named superior giving an order — but through continuous, often unseen observation that makes subjects regulate their own conduct in anticipation of being watched, a dynamic he modeled on Bentham's panopticon. Automated administrative monitoring — algorithmic risk-scoring, continuous digital audit trails, system-logged compliance checks — updates Foucault's disciplinary mechanism with a literalness he could only have described metaphorically: the "supervisor" enforcing Fayol's discipline principle is, in a system-level bureaucracy, not a person who might be absent or lenient, but an always-on recording system. Zuboff (2019) extends this line of critique to the private data-driven infrastructures that increasingly underpin public digital services, arguing that platforms built to extract and monetize behavioral data create asymmetries of knowledge and power between institutions and individuals that closely track what Fayol called equity — fair and considerate treatment — but with the crucial difference that the asymmetry is now embedded in commercially owned infrastructure that public administrations do not fully control even when they rely on it. Read alongside Fayol, Foucault's and Zuboff's critiques do not so much contradict the destabilization argument developed below as sharpen it: what looks, from a Fayolian perspective, like the loss of a locatable authority relationship looks, from a Foucauldian or surveillance-capitalism perspective, like authority relocating into infrastructures of observation that are harder to see and harder to hold accountable precisely because they no longer resemble a named superior at all.

From street-level to system-level bureaucracy

Public administration scholarship on digital transformation developed, for the most part, independently of any explicit engagement with Fayol, but its central empirical finding speaks directly to his principles. Bovens and Zouridis (2002), in what remains the field's most cited account of this shift, describe how information and communication technology has transformed many large executive public agencies from street-level bureaucracies — in which individual officials exercised discretion in face-to-face encounters with citizens — into system-level bureaucracies, in which system analysts and software designers, rather than caseworkers, embed administrative rules directly into automated decision systems. Citizens in these settings often never interact with a named official at all; the "decision" is issued by a system whose internal logic may be opaque even to the agency that deployed it. Busch and Henriksen (2018), reviewing the broader literature on information technology and administrative discretion, describe a parallel narrowing of "digital discretion": the room officials have to exercise judgment shrinks as more of the decision rule is encoded in advance into software, shifting the exercise of discretion upstream, to the system's designers, and away from the frontline official Fayol's principles of discipline and authority were built to describe. This "curtailment thesis," however, is not the only reading the digital-government literature supports, and a fair account of the field must weigh the counter-evidence rather than citing only the studies that confirm destabilization. Buffat (2015), reviewing the same body of e-government research, argues for a competing "enablement thesis": in a number of documented cases, digital tools give frontline officials additional resources — faster access to case histories, cross-referenced records, decision-support flags — that expand rather than shrink their effective discretion, and officials frequently find informal ways to work around rigid system logic when it produces poor outcomes, preserving a functioning version of the very judgment Fayol's principles of authority and initiative presuppose. Recent ethnographic work on Danish digitalized agencies (as reviewed in the broader public-bureaucracy literature)

similarly finds that digital transformation both enhances and distorts Weberian bureaucratic features simultaneously rather than eliminating them outright, meaning any single case can display destabilization on one Fayol principle and preservation or enablement on another at the same time. This article's claim, developed below, that unity of command, the scalar chain, and equity are the principles most consistently destabilized should therefore be read as an argument about where the balance of evidence currently points, not as a claim that curtailment is universal or that the enablement thesis has been refuted.

This shift has accelerated further with the introduction of artificial intelligence into public administration. Zuiderwijk et al. (2021), systematically reviewing the literature on AI in public governance, identify a recurring set of implications — efficiency gains alongside new risks to transparency, fairness, and accountability — that map closely onto exactly the principles Fayol used to describe well-functioning administration: authority (who is accountable when an algorithm errs), equity (whether automated decisions treat citizens fairly), and discipline (how compliance is verified when the "supervisor" is a model rather than a person). Ahn and Chen (2022), surveying government employees directly, find that public employees' willingness to support AI in government is shaped by their perceptions of its long-term harms and benefits, its likely effect on human labor, and whether it can be trusted to make reasonable ethical decisions, with prior familiarity or hands-on experience using AI applications also increasing support; they conclude that training and education about AI technologies are what most reliably build the culture of innovation needed for AI-augmented public administration to succeed. This is compatible with, though narrower than, Fayol's own principle of initiative, since an employee's willingness to engage constructively with a new administrative tool depends heavily on how that tool is perceived to affect their own judgment and labor, not on the tool's technical capability alone. Chen et al. (2023) extend this into a broader account of how AI reshapes public values, arguing that value impacts depend heavily on governance choices made during implementation rather than on the technology itself — an argument compatible with Fayol's own insistence that his principles required judgment in application rather than mechanical enforcement.

Defining and measuring the transformation

Two further contributions help specify what "digital transformation" means precisely enough to be tested against Fayol's principles rather than invoked as a vague trend. Vial (2019), reviewing the broader information-systems literature, defines digital transformation as a process whereby digital technologies trigger significant changes to an organization's properties through combinations of information, computing, communication, and connectivity technologies, and stresses that the process reshapes organizational structures — including, centrally, the hierarchical structures Fayol's principles were built to describe — as much as it reshapes external service delivery. Mergel et al. (2019), interviewing forty public-sector digital transformation experts, similarly find that practitioners define the process less as a technology adoption exercise than as a change in the underlying operating model and culture of public organizations, including the erosion of traditional bureaucratic hierarchy and the growing centrality of cross-functional, less strictly hierarchical project teams — a direct, if rarely acknowledged, departure from Fayol's scalar-chain and unity-of-command principles. Meijer and Bekkers (2015), synthesizing the fragmented e-government research field into a coherent metatheory, likewise identify centralization of information and decision-making infrastructure as one of digital government's most consistent effects, giving Fayol's principle of centralization new technical means without settling the question of what degree of centralization is appropriate that Fayol always treated as context-dependent. Fountain's (2001) concept of the "virtual state" anticipated much of this: she argued two decades ago that information technology does not simply speed up existing bureaucratic processes but enacts new organizational forms altogether, frequently cutting across the very jurisdictional and hierarchical boundaries Fayol's scalar chain assumed were fixed.

Algeria's measured digital transformation

Behind Algeria's EGDI trajectory sits a documented set of concrete administrative reforms, not only an abstract score. The government launched a national public-services portal, known since 2022 as bawabatic.dz, consolidating several hundred digitized procedures — roughly 300 at launch, expanded toward 400 by 2023 — across some 29 ministerial departments, allowing round-the-clock access to services previously requiring an in-person visit (Services du Premier Ministre, 2022). A dedicated Haut-Commissariat à la Numérisation, attached directly to the Presidency since 2023, has since coordinated several hundred further digitalization projects across the tax administration, customs, civil-status records, healthcare, justice, and digital-identity systems (Aman Alliance, 2024; Interfil Algérie, 2025), and in October 2025 the government announced Dzair Services, a further platform intended to unify these previously separate digitized services behind a single, interoperable national architecture (Njoya, 2025). These are precisely the kinds of concrete reforms — a single national portal replacing dozens of separate ministerial counters, an interoperability layer letting agencies exchange verified citizen data automatically — that plausibly reconfigure Fayol's scalar chain and unity-of-command principles in practice, by routing an increasing share of citizen-facing administrative decisions through a shared digital architecture rather than through the sequence of named officials each principle presupposes.

Algeria's own trajectory, tracked through the United Nations E-Government Development Index since 2003, offers a concrete empirical anchor for a debate that too often proceeds through generic claims about "digitalization" in the abstract. Algeria's overall EGDI score rose from 0.300 in 2016 to 0.423 in 2018, 0.517 in 2020, 0.561 in 2022, and 0.596 in 2024 (UN DESA, 2024), placing the country in the UN's "high EGDI" category by the most recent survey cycle — a sustained rise across four consecutive biennial survey rounds rather than a single isolated improvement. Table 1 situates Fayol's fourteen principles against the digital-government literature reviewed above, and Figure 2 presents Algeria's overall EGDI trajectory in full.

Table 1

Fayol's fourteen principles of administration reassessed under digital transformation

Fayol's principle (1916)	Classical meaning	Digital-era manifestation or challenge	Key source
Division of work	Specialization increases efficiency and skill.	Intensified, not displaced: tasks are further subdivided between human judgment and automated processing.	Ahn & Chen (2022)
Authority and responsibility	The right to give orders comes paired with accountability for outcomes.	Destabilized: automated decision systems exercise de facto authority while formal responsibility remains diffuse.	Bovens & Zouridis (2002)
Discipline	Obedience and respect for agreed rules, largely enforced by supervisors.	Reconfigured: compliance is increasingly enforced by system design itself rather than supervisory oversight.	Busch & Henriksen (2018)
Unity of command	Each employee receives orders from one superior only.	Directly challenged: employees and citizens can receive conflicting directives from multiple automated systems.	Bovens & Zouridis (2002)
Unity of direction	One plan, one head, for activities with the same objective.	Reinforced in form, altered in substance: dashboards and analytics	Meijer & Bekkers (2015)

		centralize strategic direction digitally.	
Subordination of individual interest	Organizational goals take precedence over personal ones.	Reframed as data-driven KPI compliance, narrowing discretionary judgment in the name of the collective goal.	Chen et al. (2023)
Remuneration	Pay should be fair and satisfactory to both parties.	Algorithmically mediated in platform work, where pay is calculated and adjusted by automated systems.	Newlands (2021)
Centralization	The degree to which decision-making is concentrated should fit the organization.	Technically enabled at unprecedented scale via cloud infrastructure, raising new questions about optimal degree.	Fountain (2001)
Scalar chain	A clear line of authority runs from top to bottom of the organization.	Partially bypassed: citizens interact directly with system-level bureaucracies, skipping intermediate human links.	Bovens & Zouridis (2002)
Order	A place for everyone and everything, materially and socially.	Intensified: digital recordkeeping and data governance pursue order with a precision paper systems could not match.	Vial (2019)
Equity	Kindliness and justice in dealing with employees and the public.	Newly at risk: algorithmic bias can encode and scale unfair treatment invisibly across an entire administration.	Zuiderwijk et al. (2021)
Stability of tenure	Excessive staff turnover is inefficient and costly.	Threatened: automation-driven restructuring raises job displacement and role instability in public agencies.	Borry & Getha-Taylor (2019)
Initiative	Employees should be encouraged to conceive and execute plans.	Ambiguous: AI augmentation can expand employee initiative or, if imposed rigidly, can suppress it (de-skilling).	Chen et al. (2023)
Esprit de corps	Harmony and union among personnel are a source of organizational strength.	Strained by remote, screen-mediated, and platform-based work that weakens face-to-face organizational cohesion.	Mergel et al. (2019)

Note. This table is an interpretive synthesis applying the destabilized/intensified/reinvented criterion defined in the Introduction; it is not a set of independently tested empirical findings. Compiled by the author(s) from Fayol's original principles (Wren et al., 2002) and the digital-government sources cited in the text.

Read against Fayol's principles, the pace of Algeria's EGDI rise documented above is itself diagnostic, independent of any breakdown into sub-components: sustained score growth of this speed typically reflects rapid expansion of a government's technical capacity for digital service delivery, and the general finding in the digital-government literature is that such technical capacity tends to arrive well ahead of the accountability and legal safeguards needed to govern it responsibly (Bovens & Zouridis, 2002; Zuiderwijk et al., 2021). The specific composition of that rise — how much reflects infrastructure investment as opposed to service redesign or human-capital development — would require consulting the disaggregated sub-index data directly from the UN E-Government Survey reports for each cycle, an analysis this

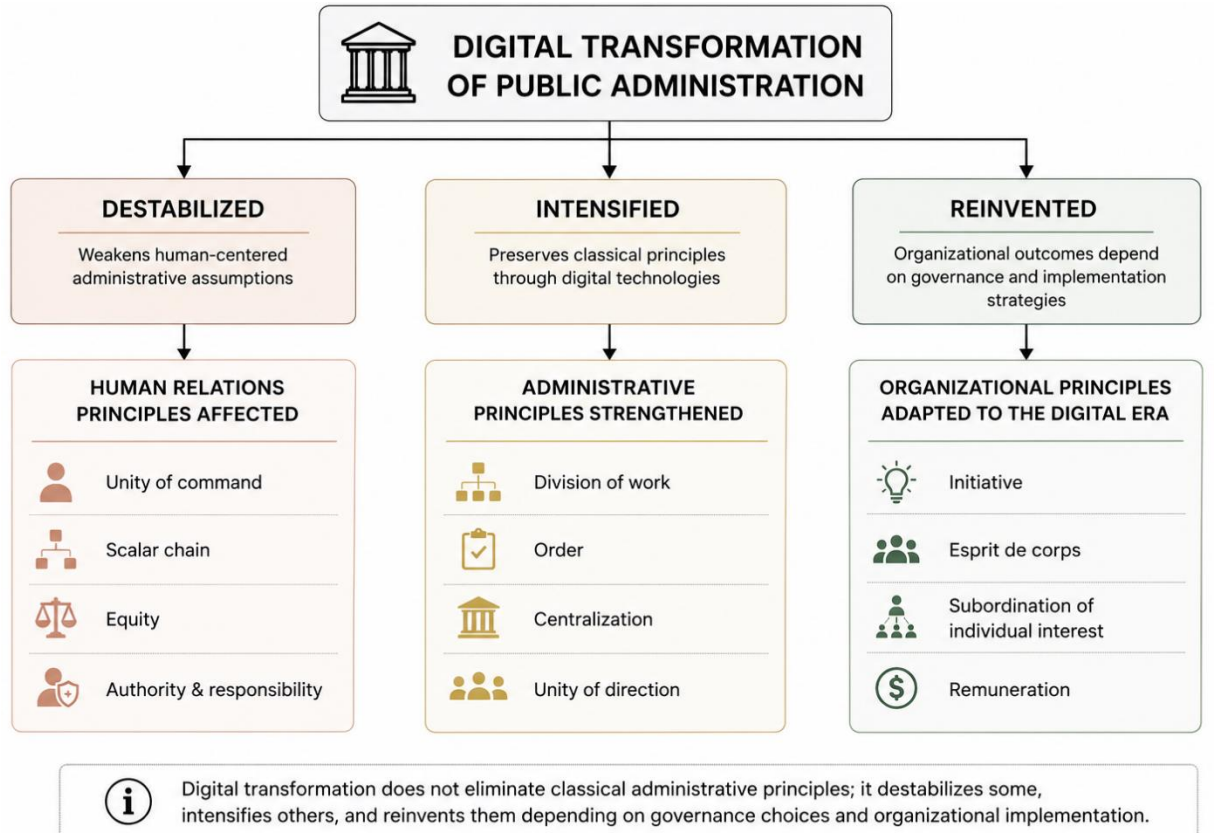
reflection article leaves to future empirical work rather than asserting from secondary summary alone.

Fayol's Principles Under Digital Transformation: Destabilized, Intensified, Reinvented

Building on the material reviewed above, this section works through Fayol's fourteen principles in three groups — destabilized, intensified, and genuinely reinvented — using Algeria's documented EGDI trajectory to ground the argument, and closes by considering what this differentiated reading implies for administrative reform. Figure 1 sets out the conceptual framework applied throughout this section, mapping the destabilized/intensified/reinvented classification directly onto Fayol's fourteen principles before the detailed argument for each grouping is developed below.

Figure 1

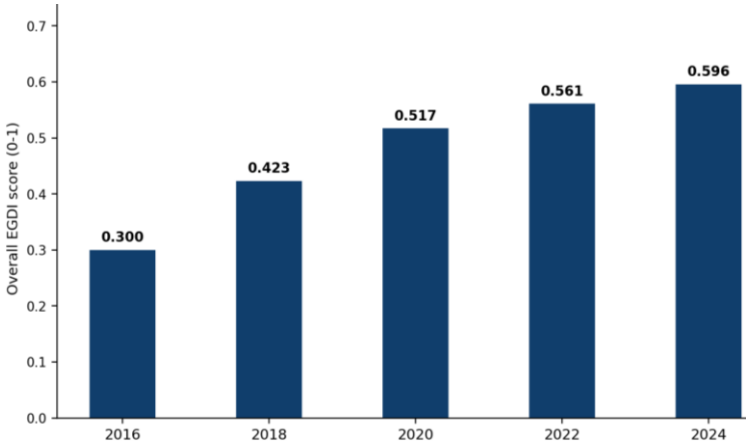
Conceptual framework mapping digital transformation onto Fayol's principles.



Note. Author-constructed conceptual diagram synthesizing the analytical criterion defined in the Introduction and applied in Table 1; it does not represent new empirical data. Each principle is listed under the classification argued for in Section 2.2.

Figure 2

*Algeria's overall E-Government Development Index (EGDI) score, 2016-2024***.**



Note. Author-constructed chart from 414ersión United Nations E-Government Knowledgebase data (UN DESA, 2024). EGDI values range from 0 to 1; the index is a composite of online-service, telecommunication-infrastructure, and human-capital sub-indices not disaggregated here.

The clearest cases of destabilization cluster around principles that presuppose a specific and traceable human relationship between the one giving the order and the one receiving it. Unity of command assumes that each subordinate receives orders from a superior; Bovens and Zouridis (2002) show that in system-level bureaucracies, citizens and even staff can simultaneously face the outputs of several automated systems, without a single responsible human to whom a complaint can be escalated. The chain of command assumes a visible line of authority connecting the top of an organization to its base; this chain is partially circumvented, not extended, when a citizen's request is resolved entirely by software without any intermediary positioned along the way (Busch and Henriksen, 2018). Fairness assumes that a supervisor's individual judgment, however fallible, can be observed, questioned, and corrected; Algorithmic bias, on the other hand, risks encoding injustice on a scale and with an invisibility that no single version could match, precisely because the flaw is embedded in a uniformly applied code rather than in the variable judgment of many individual officials (Zuiderwijk et al., 2021). In each of these three cases, digital transformation not only modifies the principle but also eliminates the specific human relationship that the principle was written to regulate.

A second set of principles survives, but only in an intensified or technically reconfigured form. The division of labor does not disappear with automation; it intensifies even further, now dividing tasks between human judgment and machine processing in ways that Fayol could not have anticipated, but whose underlying logic—specialization increases efficiency—he would likely have recognized (Ahn & Chen, 2022). Order, Fayol's principle that there should be "a place for everyone and everything," finds perhaps its most literal fulfillment to date in the data governance architectures demanded by digital transformation, in which every record, transaction, and edit must be traceable to a specific place in a specific system (Vial, 2019). Centralization, which Fayol treated as a matter of organizational judgment rather than a fixed rule, has simply acquired new technical means—cloud infrastructure enables a degree of information centralization that Fayol's paper-based organizations could never have achieved—without resolving the question, which Fayol left open, of how much centralization is truly appropriate for a given administrative function (Meijer & Bekkers, 2015; Fountain, 2001).

A third, more ambiguous group exhibits principles that are actively being reinvented, their fate depending on implementation decisions rather than being determined by the technology

itself. Initiative is the clearest example: Ahn and Chen (2022) find that public sector employees' willingness to adopt AI depends on their perceptions of the technology's effect on human work and their prior familiarity with it, and conclude that structured training is what transforms that willingness into genuine support. This means that whether AI augments or displaces employee initiative in practice is substantially a matter of organizational readiness and communication, not a fixed property of the technology itself. Chen, Ahn, and Wang (2023) generalize this finding: the public values that digital transformation ultimately protects or harms—including several of Fayol's principles—are far more determined by the governance decisions surrounding implementation than by the presence of AI as such. Esprit de corps is similarly caught in the balance: remote, screen-mediated, platform-based work possibly weakens the face-to-face organizational cohesion that Fayol had in mind (Mergel et al., 2019); however, nothing in the digital transformation suggests that this weakening is inevitable, but rather a product of how hybrid and remote work is organized.

Algeria's own trajectory illustrates why this three-pronged distinction matters more than a general verdict on "digitalization." A sustained increase in the overall EGDI score like Algeria's (UN DESA, 2024) describes an administration progressively acquiring the technical capacity associated with bureaucracy at the system level. According to the argument developed here, whether this acquired capacity destabilizes unity of command, the scalar chain, and fairness, or leaves them intact, depends on whether compensating safeguards—clear accountability rules for automated decisions, channels for challenging them, and active bias auditing—are being built at the pace of this capacity or are lagging behind. The digital governance literature concludes that safeguards often lag behind precisely because technical systems can be implemented faster than the legal and administrative frameworks needed to govern them (Bovens & Zouridis, 2002; Zuiderwijk et al., 2021). Confirming whether this delay applies specifically to the case of Algeria would require the kind of disaggregated, agency-level analysis that this reflection article does not undertake, and which is noted as a direction for future research below.

This differentiated versioning has direct implications for administrative reform, both in Algeria and in comparable developing-country contexts seeking rapid e-government implementation. Rather than treating digital transformation as either an outright threat to classical administrative principles or a neutral technical upgrade that leaves them untouched, reformers would be better served by Fayol's own three-pronged diagnosis: shoring up the principles being destabilized (unity of command, scalar chain, fairness) with new, explicit accountability and appeal mechanisms specifically designed for automated versioning systems, since the old mechanisms assumed a human version maker; recognizing and formalizing the principles being intensified (version of work, order) as deliberate design choices rather than incidental side effects of the new software; and treat reinventable principles (initiative, esprit de corps) as genuinely open issues that must be resolved through implementation management, and not as casualties that are automatically sacrificed for the sake of efficiency.

CONCLUSIONS

Henri Fayol's fourteen principles of management, formulated in 1916 for organizations operating with paper records and face-to-face communication, do not uniformly survive digital transformation. Unity of command, chain of command, and equity are directly destabilized by algorithmic management, as each presupposes a tangible human relationship between the giver and receiver of the order—a relationship that systemic bureaucracy dissolves. Division of labor, order, and centralization are not discarded but rather intensified and technically reconfigured, preserving their underlying logic while acquiring new digital means. Initiative and teamwork are not merely destabilized or intensified but genuinely reinvented, and their fate depends on the implementation decisions that remain under the control of managers. The documented rise of EGDI in Algeria (UN DESA, 2024) illustrates why this distinction is

important in practice: an administration can acquire the technical capacity for systemic bureaucracy long before it has built the accountability, appeal, and bias audit mechanisms that would allow it to use that capacity without destabilizing the very principles—responsible authority, equitable treatment, a chain of command along which citizens can appeal—that Fayol's doctrine was designed to protect.

This sequencing risk is not unique to Algeria; It is plausible that this will be repeated in the public administrations of developing countries seeking to implement e-government under similar constraints: donor-funded infrastructure programs that arrive faster than reform of domestic administrative law, technical assistance focused on digitizing services rather than on the appeal and audit mechanisms on which classic accountability depends, and legacy bureaucracies whose scalar chains and unity of command structures were often inherited from colonial or post-independence administrative models that were not designed with process automation in mind. For public institutions in the Global South considering similar digital transformation programs, the practical value of the framework developed here lies less in the specific figures for Algeria than in the diagnostic sequence it recommends: before automating a given administrative function, identify which of Fayol's principles it currently relies on, apply the destabilization/intensification/reinvention test, and, where destabilization is likely, build in a compensatory accountability mechanism—a designated appeals officer, a documented audit trail, a grievance procedure—before implementation, rather than after a scandal forces it. This ordering, low-cost relative to the infrastructure investment it safeguards, is perhaps the most transferable recommendation this article offers to administrations operating with more limited resources and less mature regulatory oversight, or to the high-income environments where most digital government research originates.

For a discipline that still relies substantially on Fayol's century-old vocabulary, this reevaluation does not amount to declaring that vocabulary obsolete. It amounts to a more precise instruction, offered here as a portable diagnostic question rather than a fixed verdict: For any given administrative function undergoing a digital transformation, does the change eliminate the specific human relationship presupposed by a classical principle (destabilization, which requires new accountability mechanisms specifically designed for the automation of decision-making), preserve the underlying logic of that relationship through new technical means (intensification, which only requires that the new means be recognized and deliberately governed), or does its outcome remain genuinely open to decisions made during implementation (reinvention, which requires active managerial attention rather than passive assumption)? Applied consistently, this three-part question transcends Fayol and beyond Algeria, to any context—whether public or private, in the Maghreb or elsewhere—where classical administrative doctrine encounters a digital transformation whose effects have not yet been categorized into these three categories.

LIMITATIONS AND FUTURE RESEARCH

As a reflective article, this paper synthesizes existing administrative theory, digital government research, and version statistics rather than presenting new primary organizational data. The tripartite classification of Fayol's principles proposed here—destabilized, intensified, reinvented—is a conceptual framework that awaits direct empirical testing rather than a finding established independently through the collection of original data. The case of Algeria, while drawing on UN version statistics, is used descriptively to anchor the argument in a documented national trajectory rather than as a controlled comparison with similar countries that might isolate the effect of infrastructure-driven digitization specifically. The broader work of Karim, Ambrosetti, and Ouadah-Bedidi (2022) on version suggests that neighboring Maghreb countries have followed distinct digital government trajectories that a more comprehensive comparative study would require. Future research could directly test the destabilized/intensified/reinvented classification, for example, through structured assessments of specific automated administrative systems against each of Fayol's fourteen

principles, or through comparative case studies of public agencies at different stages of digital transformation that rely on disaggregated data from the EGDI sub-index (online services, telecom infrastructure, human capital) to directly examine whether technical capability tends to overcome accountability safeguards, rather than inferring that sequence solely from the overall index score, as has been done in this article.

Conflict of Interest Statement

The author declares that there are no conflicts of interest regarding the publication of this manuscript.

REFERENCES

Ahn, M. J., & Chen, Y. C. (2022). Digital transformation toward AI-augmented public administration: The perception of government employees and the willingness to use AI in government. Government Information Quarterly. https://doi.org/10.1016/j.giq.2021.101664

Borry, E. L., & Getha-Taylor, H. (2019). Automation in the public sector: Efficiency at the expense of equity? Public Integrity, 21(1), 6-21. https://doi.org/10.1080/10999922.2018.1455488

Bovens, M., & Zouridis, S. (2002). From street-level to system-level bureaucracies: How information and communication technology is transforming administrative discretion and constitutional control. Public Administration Review, 62(2), 174-184. https://doi.org/10.1111/0033-3352.00168

Buffat, A. (2015). Street-level bureaucracy and e-government. Public Management Review, 17(1), 149-161. https://doi.org/10.1080/14719037.2013.771699

Busch, P. A., & Henriksen, H. Z. (2018). Digital discretion: A systematic literature review of ICT and street-level discretion. Information Polity, 23(1), 3-28.

Chen, Y. C., Ahn, M. J., & Wang, Y. F. (2023). Artificial intelligence and public values: Value impacts and governance in the public sector. Sustainability, 15(6), 4796. https://doi.org/10.3390/su15064796

Fayol, H. (1949). General and industrial management (C. Storrs, Trans.). Pitman. (Original work published 1916)

Foucault, M. (1977). Discipline and punish: The birth of the prison (A. Sheridan, Trans.). Pantheon Books. (Original work published 1975)

Fountain, J. E. (2001). Building the virtual state: Information technology and institutional change. Brookings Institution Press.

Gulick, L. (1937). Notes on the theory of organization. In L. Gulick & L. Urwick (Eds.), Papers on the science of administration (pp. 3-45). Institute of Public Administration.

Karim, M. S., Ambrosetti, E., & Ouadah-Bedidi, Z. (2022). Demographic features in West Asian and North African countries: The impact of population policies. In J. F. May & J. A. Goldstone (Eds.), International handbook of population policies (pp. 229-254). Springer. https://doi.org/10.1007/978-3-031-02040-7_11

Meijer, A., & Bekkers, V. (2015). A metatheory of e-government: Creating some order in a fragmented research field. Government Information Quarterly, 32(3), 237-245. https://doi.org/10.1016/j.giq.2015.04.006

Mergel, I., Edelmann, N., & Haug, N. (2019). Defining digital transformation: Results from expert interviews. Government Information Quarterly, 36(4), 101385. https://doi.org/10.1016/j.giq.2019.06.002

Newlands, G. (2021). Algorithmic surveillance in the gig economy: The organization of work through Lefebvrian conceived space. Organization Studies, 42(5), 719-737. https://doi.org/10.1177/0170840620937900

Services du Premier Ministre (Algérie). (2022). Le Premier Ministre procède au lancement officiel du portail gouvernemental des services publics. https://premier-ministre.gov.dz/fr/post/le-premier-ministre-procede-au-lancement-officiel-du-portail-gouvernemental-des-services-publics

United Nations Department of Economic and Social Affairs. (2024). E-Government Development Index: Algeria country profile [Data set]. E-Government Knowledgebase. https://publicadministration.un.org/egovkb/en-us/Data/Country-Information/id/3-Algeria

Vial, G. (2019). Understanding digital transformation: A review and a research agenda. Journal of Strategic Information Systems, 28(2), 118-144. https://doi.org/10.1016/j.jsis.2019.01.003

Weber, M. (1978). Economy and society (G. Roth & C. Wittich, Eds.). University of California Press. (Original work published 1922)

Wren, D. A., Bedeian, A. G., & Breeze, J. D. (2002). The foundations of Henri Fayol's administrative theory. Management Decision, 40(9), 906-918. https://doi.org/10.1108/00251740210441108

Zuboff, S. (2019). The age of surveillance capitalism: The fight for a human future at the new frontier of power. PublicAffairs.

Zuiderwijk, A., Chen, Y.-C., & Salem, F. (2021). Implications of the use of artificial intelligence in public governance: A systematic literature review and a research agenda. Government Information Quarterly, 38(3), 101577. https://doi.org/10.1016/j.giq.2021.101577

Aman Alliance. (2024, December). 2024: le parachèvement du processus de transformation numérique, un enjeu majeur pour instaurer la transparence et améliorer les performances. Agence Presse Service, republished by Aman Alliance. https://www.aman-alliance.org/Home/ContentDetail/84577

Interfil Algérie. (2025, April 7). Rapport : un état des lieux du numérique en Algérie - 2025. https://www.interfilalgerie.com/etat-du-numerique-en-algerie-2025/

Njoya, S. (2025, October 17). Dzair Services : l'Algérie centralise ses services numériques dans un portail unique. We Are Tech Africa. https://www.wearetech.africa/fr/fils/actualites/tech/dzair-services-l-algerie-centralise-ses-services-numeriques-dans-un-portail-unique