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Digital transformation and knowledge-based process management in public services: barriers, enablers and sociotechnical dynamics

Darci de Borba Santos Júnior

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TRANSFORMAÇÃO DIGITAL E GESTÃO DE PROCESSOS BASEADA EM CONHECIMENTO NOS SERVIÇOS PÚBLICOS: BARREIRAS, FACILITADORES E DINÂMICAS SOCIOTÉCNICAS

DARCI DE BORBA SANTOS JÚNIOR

ORCID: <https://orcid.org/0000-0001-9851-5034>

<darci17@gmail.com>

Instituto de Pesquisa Econômica Aplicada (Ipea). Brasília, Distrito Federal (DF), Brasil

RESUMO: Governos investem de forma continuada em transformação digital, mas parcela expressiva das iniciativas não converte capacidade tecnológica em capacidade administrativa. A literatura já demonstrou que os obstáculos raramente são técnicos, embora não tenha especificado por qual mecanismo organizacional essa conversão ocorre ou deixa de ocorrer. Esta lacuna é teórica e explicativa, e não apenas empírica. O artigo pergunta como barreiras, facilitadores e dinâmicas sociotécnicas condicionam a transformação digital quando o fenômeno é examinado pela ótica da gestão de processos baseada em conhecimento. Adota-se revisão integrativa, conduzida segundo as cinco etapas de Whitemore e Knafl (2005), com codificação temática em três ciclos sobre estudos de transformação digital, gestão de processos, gestão do conhecimento e modernização do setor público. Os achados organizam barreiras e facilitadores em cinco domínios simétricos e identificam quatro dinâmicas recorrentes: desacoplamento entre estratégia e processo executado, digitalização do legado processual, erosão do conhecimento tácito na automação e assimetria entre integração técnica e institucional. A contribuição teórica consiste em definir a gestão de processos baseada em conhecimento como construto de três dimensões, explicitação, integração de conhecimento e revisabilidade, e em demonstrar que ele opera como mecanismo de tradução entre a camada tecnológica e a camada institucional. Cinco proposições formalizam o mecanismo e explicam por que capacidades dinâmicas produzem efeitos irregulares sobre o desempenho no setor público. Como implicação, a efetividade da transformação digital depende da sequência em que compromissos irreversíveis são assumidos, e não da sofisticação das tecnologias adotadas.

Palavras-chave: transformação digital, gestão de processos, gestão do conhecimento, capacidades estatais, abordagem sociotécnica

DIGITAL TRANSFORMATION AND KNOWLEDGE-BASED PROCESS MANAGEMENT IN PUBLIC SERVICES: BARRIERS, ENABLERS AND SOCIOTECHNICAL DYNAMICS

ABSTRACT: Governments invest continuously in digital transformation, yet a large share of initiatives fails to convert technological capacity into administrative capacity. The literature has established that the obstacles are seldom technical, but it has not specified the organisational mechanism through which the conversion happens or fails. The gap is theoretical and explanatory rather than merely empirical. The article asks how barriers, enablers and sociotechnical dynamics condition digital transformation when the phenomenon is examined through knowledge-based process management. An integrative review was conducted following the five stages of Whittemore and Knafl (2005), with three cycles of thematic coding over studies on digital transformation, process management, knowledge management and public sector modernisation. The findings organise barriers and enablers into five symmetrical domains and identify four recurrent dynamics: decoupling between strategy and enacted process, digitisation of the procedural legacy, erosion of tacit knowledge under automation, and asymmetry between technical and institutional integration. The theoretical contribution lies in defining knowledge-based process management as a three-dimensional construct, comprising explicitation, knowledge integration and revisability, and in showing that it operates as a translation mechanism between the technological and the institutional layers of public administration. Five propositions formalise the mechanism and account for why dynamic capabilities produce uneven effects on performance in government. As an implication, the effectiveness of digital transformation depends on the sequence in which irreversible commitments are made rather than on the sophistication of the technologies adopted.

Keywords: digital transformation, process management, knowledge management, state capacity, sociotechnical approach

INTRODUCTION

Governments have spent two decades digitising service delivery, integrating administrative registries, automating decision flows and building platform infrastructures. The expectation attached to these investments has remained stable across very different institutional settings. Digital technologies are meant to lower transaction costs, shorten response times, widen access and make

administrative action traceable (Mergel et al., 2019; Latupeirissa et al., 2024). What has not remained stable is the record of delivery. Reviews of the field report initiatives that stall at the pilot stage, produce localised gains that never propagate, or are declared complete while the service they were meant to reorganise continues to behave as before (Barcevičius et al., 2019; Haug et al., 2024).

Explanations for that record have converged on a negative claim. Technology adoption in public organisations is mediated by legal, organisational and political factors, and the obstacles that matter most are rarely technical (Liva et al., 2020). The claim is well supported and, by now, uncontroversial. Its analytical value is nonetheless limited, because knowing that non-technological factors matter says nothing about how technological capacity becomes administrative capacity. Existing work names the ingredients of transformation without specifying the process that combines them. Barriers are enumerated, enablers are listed, and the causal path between them is left implicit.

The gap addressed here is therefore explanatory rather than descriptive. Three literatures hold the pieces of an answer and have engaged one another only sporadically. Digital government research has mapped drivers, obstacles and outcomes with growing empirical precision, treating process and knowledge as background conditions. Business process management has produced elaborate capability and maturity frameworks whose transfer to government remains uneven and often blind to the legal constitution of administrative action (Niehaves et al., 2013; Gębczyńska & Vladova, 2023). Knowledge management research has shown that public organisations are knowledge-intensive and that the quality of knowledge management accompanies the success of digital government, yet describes the relationship as exploratory (Alvarenga et al., 2020), and its implementation frameworks leave process measurement, results measurement and integration with information technology underspecified (De Borba & Chaves, 2021). What is missing is a construct that connects the three, and a mechanism that explains why the same technological investment yields transformation in one administration and inertia in another.

That absence has practical consequences. Public managers who read the barrier literature learn that legacy systems, weak leadership and fragmented knowledge impede transformation. They do not learn at which point in a transformation trajectory those factors become binding, nor which decisions foreclose later correction. Evaluation frameworks inherit the same limitation and measure system adoption because they lack a theory of what adoption is supposed to change.

The article addresses one question. How do barriers, enablers and sociotechnical dynamics condition digital transformation in public services when the phenomenon is examined through the

lens of knowledge-based process management? The general objective is to build an analytical model of the conditions under which digital transformation produces effective change in public organisations. Four specific objectives follow. The first is to systematise reported barriers into analytically consistent domains. The second is to identify the enablers associated with each domain and examine their relational structure. The third is to characterise the sociotechnical dynamics that connect barriers and enablers along the trajectory of an initiative. The fourth is to formalise, as propositions open to empirical test, the mechanism through which knowledge-based process management conditions the conversion of technological into administrative capacity.

Method and object are matched deliberately. An integrative review allows empirical and theoretical sources produced under heterogeneous designs to be combined in a single synthesis, which suits a question situated between fields that do not share methodological conventions (Whittemore & Knafl, 2005; Torraco, 2016). The review followed a protocol, coded the corpus in three cycles and treated divergent findings as evidence of configurational effects rather than as noise to be resolved by majority.

Three contributions are advanced and demonstrated in the body of the article. Theoretically, knowledge-based process management is defined as a construct with three dimensions, explicitation, knowledge integration and revisability, and is positioned as the mechanism that translates between the technological and institutional layers of public administration. The mechanism is formalised in five propositions, each traceable to a documented finding, and bounded by conditions under which it is expected to hold. Methodologically, the article proposes that barriers and enablers be treated as opposite states of shared organisational variables, which reframes an inconsistency that the literature has treated as measurement error. Practically, it offers a criterion for sequencing transformation decisions that follows from the model rather than from managerial convention.

Five sections follow. The first develops the theoretical framework and defines the construct. The second describes the method. The third presents the findings. The fourth discusses them and builds the model. The fifth states the contributions and their implications. Final considerations close the article with limitations and a research agenda.

1. THEORETICAL FRAMEWORK

1.1 Digital transformation in the public sector

Vial (2019) frames digital transformation as a process in which digital technologies produce disruptions that trigger strategic organisational responses aimed at altering value creation paths, while the organisation manages the structural changes and organisational barriers that shape its outcomes. Two features of that framing matter here. Transformation is a trajectory rather than a condition, so its study requires attention to sequence. And organisational barriers belong inside the definition, which forbids treating them as external contingencies to be controlled away.

Mergel et al. (2019) carried the concept into government through expert interviews, defining digital transformation as a holistic revision of core processes and services that goes beyond digitising existing procedures and reaches organisational culture, structures and external relationships. Their definition separates two movements that most initiatives combine. Digitisation converts an analogue procedure into a digital one and preserves its logic. Transformation revises the logic. The separation is analytically clean and empirically hard to observe, since strategy documents rarely declare the proportion in which the two movements are mixed. Much of the confusion in the field follows from that silence.

Later work refined the account along three lines. Gong et al. (2020) traced five years of transformation in a hierarchical bureaucracy and found that change propagates in waves, mixing radical and incremental adjustments, and that organisational flexibility grows alongside transformation rather than preceding it. Flexibility appears as a product of the trajectory, which weakens readiness-based explanations. Haug et al. (2024), reviewing 164 studies, showed that societal-level transformative effects accumulate from incremental organisational changes, so the magnitude of any single intervention is a poor indicator of transformation.

The second line concerns capabilities. Santos (2024) maps five emerging areas in which the dynamic capabilities view has been applied to public organisations and identifies digital transformation as one of them, while noting that longitudinal and comparative evidence remains scarce. Freitas Junior et al. (2023), reviewing 101 studies on the capabilities firms mobilise under digital economy pressures, reduce the construct to sensing and responsiveness, a parsimony obtained in corporate settings whose transfer to administrations bound by legal mandate has not been examined. Panagiotopoulos et al. (2023) surveyed 255 Greek municipalities and demonstrated that

dynamic capabilities influence performance improvement directly and indirectly, identifying the organisational resources on which those capabilities rest. Results elsewhere are less confirmatory. Hanum et al. (2026) found no direct effect of sensing, seizing and reconfiguring on transformation performance and reported full mediation by organisational agility, with leadership support and digital literacy acting as enabling conditions. Ongena et al. (2026) found a strong association between digital maturity and dynamic capabilities in the Dutch national government, yet no significant mediating effect on internal or external performance, with organisational learning flagged as high-impact and underdeveloped. Capabilities evidently matter. Their path to performance runs through something the literature has not isolated.

The third line concerns organisational capacity in structural terms. Gascó-Hernández et al. (2022) compared smart city initiatives in Milan, Barcelona and Munich and found that capacity was enhanced along two dimensions, management and collaboration, with a dedicated organisational unit appearing alongside strategy and leadership. Maheshwari et al. (2025) combined a systematic review with morphological analysis and identified leadership commitment, change management, public engagement and private sector collaboration as enablers, against inadequate infrastructure, resistance to change and regulatory constraints as inhibitors. Convergence across such different designs deserves attention, and the results section returns to it.

One question remains open in all three lines. Strategy, leadership, capabilities and collaboration are exercised upon something. In public administration that something is the administrative process, through which legal mandates become action, discretion is bounded, accountability is made traceable and organisational knowledge is stored and transmitted. Process is where the conversion of technology into administrative capacity either happens or fails.

1.2 Process management and knowledge management in public organisations

Business process management arrived in public administration carrying assumptions formed in industrial and commercial settings. Gullledge and Sommer (2002) warned early that public organisations would have to alter their structures, and not only their enterprise systems, for process management to work, an argument that anticipates much of the later transformation debate. Niehaves et al. (2013) studied local governments through combined survey and case evidence, identified process management challenges specific to government and questioned maturity models built on convergence towards an ideal state, proposing instead developmental models grounded in

divergence. Their critique undermines an assumption embedded in many national digital strategies, namely that a single optimal process configuration exists towards which all administrations should move.

Evidence on public sector specificity has accumulated since. Lederer and Mahr (2024) used a Delphi design with public sector experts and found that authorities face constraints arising from their structures and mandates, including transparency obligations, external regulation and evaluation against citizen-perceived performance, and that a process view across systems demands attention to interfaces with other public and private institutions. Gębczyńska and Vladova (2023) reviewed maturity assessment models applicable to government, clarified how process maturity and e-government maturity models relate, and exposed the ambiguity that surrounds model selection. Vilela and Alves (2025) applied a purpose-built model in a Brazilian public institution through design science research and found maturity below level two, which measures the distance between the normative sophistication of the instruments and the observed condition of administrations. Kerpedzhiev et al. (2020) showed that digitalisation itself reshapes the discipline, since new capability areas become necessary once technologies transform existing processes, enable new ones and change the available forms of automation.

Knowledge management developed a parallel conversation. Public organisations are knowledge-intensive in a precise sense. The value of an administrative process lies in the correct application of normative and technical knowledge to particular cases, not in the physical transformation of inputs. Alvarenga et al. (2020) combined a Scopus-based review with a survey of employees in two areas of the Portuguese Ministry of the Environment and found the field at an exploratory stage, with digital government success apparently related to the quality of organisational knowledge management, the two domains complementing each other. Antunes (2022) posed the question in terms close to the one pursued here, asking whether knowledge management maturity enhances process improvement through technology. De Borba and Chaves (2021), comparing ten knowledge management implementation frameworks published in high-ranked journals, found that none specifies how process results are measured or how the framework integrates with information systems, which is the same silence that separates the two conversations. De Borba et al. (2020) report a parallel silence in the smart city literature, where knowledge management is invoked for urban governance without linking transparency and governance mechanisms to knowledge practice.

Vignieri and Santoni (2025) came closest to specifying a mechanism. Combining a narrative review with an explanatory case study of an open-source digital government platform, they argued that digital transformation catalyses knowledge assets for public value creation under three conditions: support capacity encompassing hands-on assistance, service design and cybersecurity; orchestrating capabilities that balance the institutional, managerial and technological dimensions of interoperability; and relational knowledge resources such as leadership and collaboration. Their formulation makes the mobilisation of knowledge conditional rather than automatic, which is the step this article builds upon.

The two conversations rarely meet. Process management research treats knowledge as an input to modelling. Knowledge management research treats process as one of several organisational routines. Neither asks what happens to organisational knowledge at the moment a process is encoded into software, which is precisely the moment when transformation initiatives become irreversible.

1.3 Knowledge-based process management and the sociotechnical premise

Knowledge-based process management is defined here as the set of organisational practices through which administrative processes are designed, executed, monitored and revised on the basis of explicit, shared and revisable organisational knowledge. The construct has three dimensions, each with a distinct referent and each varying independently of the others.

Explicitation refers to the degree of correspondence between the enacted process and its documented representation. High explicitation means that those who execute the process recognise themselves in its model, including the treatment of exceptions. Low explicitation means that the model describes a prescribed sequence that practitioners work around. The dimension is not the same as documentation volume. An administration may hold extensive process manuals and score low, because the manuals describe what should happen.

Knowledge integration refers to the degree to which normative, technical and experiential knowledge dispersed across units and individuals is articulated within process design. Public processes typically distribute their constitutive knowledge across at least three positions: a legal unit that fixes the normative parameters, a technical unit that specifies the system, and an operational unit that holds accumulated case experience. Integration measures whether design brings the three into contact or proceeds from one of them.

Revisability refers to the cost and speed at which an encoded process can be altered once it has become part of technical infrastructure. The dimension has a technological component, related to architecture and modularity, and an institutional component, related to the normative level at which the process is prescribed. A process fixed by decree and hard-coded into a monolithic system has near-zero revisability, whatever the maturity of the organisation that operates it. De Borba and Brinkhues (2025), reviewing the alignment of artificial intelligence in business process management with the ISO 42001 standard, arrive at two constructions that anticipate the dimensions proposed here. Their notion of dual transparency, covering the technical and the operational visibility of an automated process, is an operational reading of explicitation. Their layered compliance architecture, which distributes oversight across design time, run time and post hoc review, is an operational reading of revisability, since it keeps the encoded process open to correction after deployment.

Separating the three dimensions has an analytical purpose. Existing constructs collapse them. Process maturity mixes explicitation with governance and measurement. Knowledge management maturity mixes integration with sharing culture and technology. Neither instrument captures revisability, which the findings below identify as the dimension that governs whether digitisation reproduces or revises the administrative logic it encodes.

The sociotechnical tradition supplies the premise that technical and social subsystems must be optimised jointly, since improving one at the expense of the other degrades the performance of the work system as a whole. Applied to government, the premise predicts that a technically sound system laid over an unrevised social system will underperform and that the failure will be attributed to the technology.

E-government research has used the premise productively. Khan et al. (2011) analysed 145 articles from core journals and found that research on developing countries had begun to balance technical and social concerns while still lacking depth. Kompella (2017) extended the multi-level perspective to e-governance through multiple Indian cases and showed that improving the spatial dimension of transformation allows actors to build organisational capabilities for information sharing and knowledge management, with better interoperation as a result. One of his observations bears directly on the present argument: process innovations stabilise product innovations. Process work is not an accompaniment to technological work but the condition of its durability.

Cordella and Contini (2012) introduced the notion of sociotechnical regimes to explain the mixed results of technically well-executed projects in the Italian judiciary, arguing that e-government

is a relationship intertwined with the values, routines, organisational settings and technological configurations embedded in a project. Bakunzibake et al. (2019) examined two Rwandan projects through interviews at eight agencies, documented changes in technology, processes and people together with secondary effects, and found a wider misfit between technical and social systems in the project where that fit had not been deliberately managed. Cordella and Iannacci (2010), drawing on the technology enactment framework, proposed the e-government enactment framework to investigate the logics embedded in system design and the political interests inscribed in policy, treating technologies as carriers of reform aims. Process design, on that reading, is a site where policy intentions are written into administrative infrastructure. Frandell and Feeney (2022) provided a quantitative demonstration in a domain usually treated as purely technical, showing with survey data from public managers in 500 United States cities that manager buy-in and perceptions interact with technical features to explain reported cyber incidents.

Three commitments follow for the analysis. Barriers and enablers are properties of configurations rather than of isolated factors. A transformation trajectory results from successive adjustments between subsystems rather than from the execution of a plan. And encoding a process into a technical system carries institutional consequences, because it fixes in infrastructure what practice had kept negotiable.

2. METHOD

Table 1 summarises the methodological design. The subsections that follow justify each choice against the research question rather than merely declaring it.

Table 1 - Summary of the methodological design

Element	Specification in this study
Philosophical position	Critical realism, with observable outcomes treated as manifestations of generative mechanisms
Logic of inquiry	Retroduction, moving from documented outcomes to the structural conditions that would produce them
Approach and nature	Qualitative, theoretical-conceptual
Review type	Integrative review, five stages of Whitemore and Knafl (2005), with Torraco (2016) and Cronin and George (2023) as complementary protocols
Purpose of the synthesis	Construct building and mechanism specification, not estimation of effect sizes or frequencies
Unit of analysis	Digital transformation initiative in a public organisation
Unit of observation	Published study reporting on such initiatives

Element	Specification in this study
Sources	Multidisciplinary academic databases and citation indexes, complemented by institutional reports with transparent methodology
Languages	English, Portuguese and Spanish
Descriptor groups	Transformation (digital transformation, digital government, e-government, public sector digitalisation); process (business process management, process management, process maturity, process orientation); knowledge (knowledge management, knowledge sharing, tacit knowledge, knowledge assets)
Search logic	Boolean strings pairing at least one transformation descriptor with at least one process or knowledge descriptor, qualified by public sector, public administration or government
Temporal window	2015 onwards, with earlier works retained when their theoretical contribution still structures the field
Complementary strategy	Backward and forward citation chaining on studies identified as central
Stopping rule	Theoretical saturation rather than exhaustive coverage
Inclusion criteria	Substantive treatment of at least one of: factors conditioning implementation of digital initiatives in public organisations; process management and digital transformation in government; knowledge management and digital government
Exclusion criteria	Technical description without organisational analysis; private organisations without transferable analytical content; methodological reporting insufficient for assessing the evidentiary basis
Evaluation of sources	Characterisation along methodological approach, empirical scope, administrative context and analytical level, in place of a single quality score
Analysis	Three coding cycles: open and descriptive, categorial by constant comparison, interpretive across domains
Treatment of divergence	Factors reported with opposite signs retained as configurational evidence rather than resolved by majority
Quality criteria	Audit trail from finding to supporting study, divergence reported rather than suppressed, transferability claimed analytically with stated boundary conditions
Limits of inference	No claims about frequency of findings; corpus skewed towards high-output contexts; discontinued initiatives underrepresented; propositions untested

Source: prepared by the author.

2.1 Design, philosophical position and unit of analysis

The study is situated in critical realism. Observable outcomes of transformation initiatives are taken as manifestations of generative mechanisms that operate in organisational structures and are activated or blocked by contextual conditions. That position justifies the analytical move made in

section 3.3, where recurrent patterns across heterogeneous settings are read as traces of a common mechanism rather than as statistical regularities. It also justifies treating contradictory findings as evidence about conditions of activation instead of as measurement error.

The logic of inquiry is retroductive. The analysis starts from documented outcomes, asks what would have to be true about organisational structures for those outcomes to occur, and formulates the answer as propositions open to falsification. Retroduction is appropriate when the object is a mechanism that cannot be observed directly and must be inferred from its effects. The propositions in section 4.2 are the product of that inference and are stated as conjectures, not as verified relationships.

The researcher position is interpretive with respect to the corpus. Primary studies are read as situated accounts produced under specific institutional and methodological conditions, and their claims are weighted accordingly.

An integrative review was chosen because the corpus is methodologically heterogeneous, spanning large-N surveys, structural equation models, multi-case designs, single case studies and conceptual essays. The integrative review is the only review method designed to combine such diverse evidence, including empirical and theoretical sources, within one synthesis (Whittemore & Knafl, 2005). Systematic reviews and meta-analyses presuppose homogeneity that this corpus does not display, and a narrative review would not have supported the construct-building objective.

The review followed the five stages of Whittemore and Knafl (2005), namely problem identification, literature search, data evaluation, data analysis and presentation. Torraco (2016) guided the treatment of the review as a form of research that produces new knowledge rather than a summary of prior work, and Cronin and George (2023) informed the handling of divergent perspectives during synthesis. Adopting an explicit protocol responds to a documented weakness in applications of the method, where search, evaluation and analysis stages are often reported too thinly to be assessed (Hopia et al., 2016).

The unit of analysis is the transformation initiative in a public organisation. The unit of observation is the published study reporting on such initiatives. Keeping the two distinct matters for inference, since claims are made about initiatives while evidence comes from accounts of them.

2.2 Search, selection and analysis

Searches covered peer-reviewed publications in English, Portuguese and Spanish in multidisciplinary academic databases and citation indexes, complemented by institutional reports whose methodology was reported transparently. Three descriptor groups were combined. The transformation group included digital transformation, digital government, e-government and public sector digitalisation. The process group included business process management, process management, process maturity and process orientation. The knowledge group included knowledge management, knowledge sharing, tacit knowledge and knowledge assets. Boolean strings paired at least one descriptor from the transformation group with at least one from the process or knowledge groups, qualified by public sector, public administration or government.

The window privileged publications from 2015 onwards, when digital transformation consolidated as an autonomous object in public administration research, and admitted earlier work whose theoretical contribution still structures the field. Backward and forward citation chaining was applied to studies identified as central. Selection aimed at theoretical saturation rather than exhaustive coverage, which is the appropriate stopping rule for an integrative design.

Inclusion required that a study address, substantively and not incidentally, at least one of three themes: factors conditioning the implementation of digital initiatives in public organisations, the relation between process management and digital transformation in government, or the relation between knowledge management and digital government. Three exclusion criteria were applied. Studies confined to technical description without organisational analysis were excluded. Studies on private organisations without transferable analytical content were excluded. Studies whose methodological reporting did not permit assessment of their evidentiary basis were excluded.

Primary sources of diverse provenance cannot be ranked on a single quality scale without distorting their claims. Each study was therefore characterised along four attributes: methodological approach, empirical scope, administrative context and analytical level. The characterisation served two functions. It allowed findings to be weighted by evidentiary basis, so that a proposition supported by a multi-country survey carries different force from one derived from a single case. And it made visible the contexts in which findings converge or diverge, which became an analytical result in its own right.

Analysis proceeded in three coding cycles. The first cycle was open and descriptive, extracting the factors each study reported as conditioning transformation while preserving the original terminology, so that convergence would not be produced by the coder. The second cycle was categorial, grouping codes into domains through constant comparison, with domain boundaries revised whenever a code resisted allocation. The third cycle was interpretive, examining relations among domains and identifying the dynamics that connect them, following the recommendation that integrative reviews draw on the analytical strategies of qualitative research to strengthen synthesis across heterogeneous sources (Whittemore & Knafl, 2005).

Two decisions taken in the second cycle require registration, because they shaped the findings. The first concerns symmetry. Barriers and enablers were coded independently, following the structure of most primary studies. Comparing the resulting domains showed that most enablers correspond to the inverse state of a barrier in the same domain. Rather than discarding the overlap as redundancy, the analysis retained it as a substantive finding, examined in section 3.4. The second decision concerns factors reported with opposite signs across studies. Such factors were retained as configurational, meaning that their effect depends on combination with others, a treatment that follows from the critical realist position stated in section 2.1 and from the sociotechnical premise adopted in section 1.3.

2.3 Quality criteria and limits of inference

Credibility was pursued by keeping an audit trail linking each finding in section 3 to the studies that support it, and by reporting divergence rather than resolving it. Transferability is claimed analytically, not statistically. The propositions in section 4.2 are offered as explanations transferable under stated conditions, and section 4.3 specifies those conditions.

Three limits restrict the inferences that follow. An integrative review does not support claims about how frequently a finding occurs in the field, so no such claims are made. The corpus is skewed towards contexts with higher scientific output, notably European countries, the United States and, more recently, Asian and Latin American administrations, which restricts transfer to administrations operating under substantially different resource conditions. Publication bias towards initiatives with reportable results underrepresents discontinued initiatives, which is a material limitation for a study concerned with conditions of failure. Section 6 returns to these limits when bounding the conclusions.

3. FINDINGS

Three sets of findings emerged from the coding cycles. The first is a typology of barriers in five domains. The second is a typology of enablers whose structure mirrors the first. The third is a set of four dynamics that connect the two along the trajectory of an initiative. A fourth result, discussed separately, concerns the relation between the two typologies.

3.1 Barriers

Five barrier domains were produced by the second coding cycle. They are analytically distinct and empirically entangled, since the reviewed studies almost never report a barrier from one domain without reporting barriers from at least one other. Table 2 presents the typology.

Table 2 - Typology of barriers to digital transformation in public services

Domain	Constitutive barriers	Predominant analytical level
Institutional-regulatory	Regulatory rigidity, normative fragmentation, incompatibility between legal design and process redesign, conformity-oriented adoption, short political cycles	Macro (system)
Organisational-managerial	Absence of process ownership, discontinuity of leadership, weak change management, misalignment between digital strategy and enacted process, budgetary rigidity	Meso (organisation)
Technological-infrastructural	Legacy systems, technical debt, low interoperability, data quality deficits, absence of data governance	Meso and micro (organisation and system)
Human-cognitive	Digital skill deficits, loss of tacit knowledge, resistance to change, knowledge fragmentation, workforce turnover	Micro (individual and team)
Relational-interorganisational	Silo mentality, deficient inter-agency coordination, misaligned incentives across levels of government, exclusion of end users from design	Macro and meso (network)

Source: prepared by the author from the reviewed literature.

Institutional-regulatory barriers originate in the normative and political architecture surrounding public organisations. Maheshwari et al. (2025) place regulatory constraints among the main inhibitors of digital adoption in governance, together with inadequate infrastructure and resistance to change. The same constraint reappears in European public administrations (Barcevičius et al., 2019) and in administrations of the Global South (Oprea, 2025), which argues for a structural rather than a context-specific reading. Two mechanisms recur in the corpus. Legal design and

process redesign are frequently incompatible, because administrative processes in government are often prescribed by legal instruments. A redesign that would be routine in a firm requires normative alteration in an agency, and the resulting asymmetry between the pace of technological change and the pace of institutional revision leaves organisations with two options. They may postpone redesign, or they may implement technology over a process they cannot modify. The second option is far more common, and section 3.3 examines what it produces.

The second mechanism operates through apparent success. Aswani (2026) combined a systematic review of 118 studies with qualitative analysis of 16 government initiatives across three continents and found that institutional pressures often lead governments to adopt digital technologies in ways that privilege conformity over organisational change, opening a gap between declared strategy and observed outcome. An organisation caught in this mechanism adopts the technology, reports compliance and does not transform, which makes the barrier invisible to compliance-based monitoring. Barcevičius et al. (2019), after reviewing close to 500 academic and grey sources, reached a converging caution, warning that much of the field rests on normative expectation rather than tested insight and calling for a clearer separation between evidence and hope.

Organisational-managerial barriers concern how transformation is organised internally. Bjerke-Busch and Aspelund (2021) studied the Norwegian Court Administration through institutional and change management lenses and found that institutional norms operate as a strong barrier, translating into individual behaviours that slow change. Their second finding, that interdependencies make sector-wide transformation necessary, connects this domain to the relational one. Kitsios et al. (2023) documented the distance between what public managers expect from transformation projects and what those projects deliver. Aswani (2026) sharpened the diagnosis by identifying leadership commitment and data governance maturity as the most decisive and the least funded components of transformation. Underperformance follows almost mechanically when the components that determine success are the ones that attract least investment, largely because neither produces a visible deliverable.

Process ownership deserves separate treatment within this domain. Process orientation requires actors accountable for end-to-end processes that cross functional boundaries (Lederer & Mahr, 2024). Public organisations are built around legal competences allocated to units rather than around processes that traverse them, and the figure of the process owner has no obvious institutional host. Where it is absent, each unit digitises its own segment and optimises locally while the trajectory

of the case across units remains unmanaged. Aggregate service time may lengthen even as every unit reports improvement.

Technological-infrastructure barriers have been documented with unusual precision. Irani et al. (2023) analysed four transformation cases in Danish, Dutch and British administrations, identified seven levels of complexity in transforming legacy systems and showed that these complexities generate the main obstacles to interoperability and integrability. Their conclusion positions legacy as an institutional inheritance rather than a technical one, since success depended on understanding the systems, the policies they serve and the administrative setting in which they operate. Abu Bakar et al. (2021, 2022), working through theoretical and empirical phases with nineteen informants, found that legacy modernisation involves human, process, product and organisational aspects and resists reduction to technical replacement. Asatiani et al. (2025) explain why rapid replacement usually fails, arguing that technical debt is treated as a technical problem while its managerial implications go unexamined.

Interoperability forms the second component of this domain and is more layered than its technical framing suggests. Alshahrani (2025) analysed six government sectors and found technical complexities in legacy integration alongside interoperability challenges, financial limits and organisational resistance. Interoperability is simultaneously technical, semantic and institutional. Systems must exchange data, the data must carry the same meaning across organisations, and the organisations must be authorised and willing to exchange it. Failures attributed to the first level frequently originate at the third, which misdirects remediation towards architecture when the obstacle is authority.

Human-cognitive barriers concern the people who execute administrative processes. Digital skill deficits recur across contexts (Deogratias & Tefurukwa, 2025; Oprea, 2025), as does resistance to change (Maheshwari et al., 2025). Two less discussed barriers in this domain carry more weight for the argument developed here. The first is the loss of tacit knowledge under automation. Administrative processes hold considerable knowledge that has never been written down, including how ambiguous cases are treated, which exceptions are legitimate and how competing normative requirements are reconciled in practice. Melo et al. (2025) analysed the modernisation of COBOL-based government systems and identified knowledge retention as a principal risk of accelerated modernisation, alongside cybersecurity and workforce disruption, with tacit knowledge transfer singled out as the hardest element. The risk is asymmetric. Explicit knowledge migrates to the new

system while tacit knowledge, which is what allowed the old process to function despite its formal deficiencies, does not.

The second is knowledge fragmentation. When knowledge relevant to a process is distributed across individuals and units without mechanisms of articulation, redesign proceeds from a partial representation. The system that results handles the modal case and fails on exceptions, generating manual workarounds whose volume erodes the efficiency gains that justified the investment. Alvarenga et al. (2020) supply the corresponding positive evidence, finding that the quality of organisational knowledge management accompanies digital government success, with the two domains reinforcing each other.

Relational-interorganisational barriers concern relations among organisations. Silo mentality, weak inter-agency coordination and misaligned incentives across levels of government appear consistently (Oprea, 2025; Alshahrani, 2025). Bjerke-Busch and Aspelund (2021) give the structural formulation, arguing that interdependence among public organisations makes sector-wide transformation necessary and that collaboration across management levels is what accelerates it. Exclusion of end users from design forms a distinct barrier within the domain. Aswani (2026) found that digital exclusion emerges when citizen-centric design is handled as a technical matter rather than as a social and political one. Weigl et al. (2024) identified three conflicts generated by user-centricity in institutionalised environments: a representation conflict produced by the normative dominance of decision-makers, an accountability conflict that inhibits user-centric innovation, and a pluralism conflict arising from the clash between social diversity and an assumed homogeneity of users. None of the three yields to better technique, since each requires institutional arbitration.

3.2 Enablers

The enabler domains mirror the barrier domains. Table 3 presents the typology.

Table 3 - Typology of enablers of digital transformation in public services

Domain	Constitutive enablers	Principal supporting evidence
Institutional-regulatory	Legal frameworks adapted to iterative redesign, regulatory experimentation, policy continuity across political cycles, alignment between digital strategy and legal instruments	Maheshwari et al. (2025); Alshahrani (2025)
Organisational-managerial	Sustained leadership commitment, dedicated transformation unit, process ownership, structured change management, data governance	Gascó-Hernández et al. (2022); Aswani (2026); Lederer and Mahr (2024)

Domain	Constitutive enablers	Principal supporting evidence
	maturity	
Technological-infrastructural	Phased legacy modernisation, interoperability architecture, data quality management, modular and revisable process encoding	Irani et al. (2023); Abu Bakar et al. (2022); Asatiani et al. (2025)
Human-cognitive	Continuous capability building, knowledge sharing mechanisms, explication of tacit knowledge before automation, organisational learning	Alvarenga et al. (2020); Vignieri and Santoni (2025); Ongena et al. (2026)
Relational-interorganisational	Inter-agency collaboration, multi-level articulation, public-private partnerships, structured user participation	Gascó-Hernández et al. (2022); Nurdin et al. (2022); Weigl et al. (2024)

Source: prepared by the author from the reviewed literature.

Leadership is the most frequently reported enabler in the corpus, and the evidence qualifies its role in a way that matters for the model built later. Hanum et al. (2026) found that leadership support operates as an enabling condition rather than as a direct amplifier of performance relationships, and Maheshwari et al. (2025) place leadership commitment among the preconditions of adoption rather than among its determinants. Leadership modulates the effect of other factors, which explains why studies that model it as a direct predictor obtain unstable coefficients.

Organisational capacity works through more tangible arrangements. Gascó-Hernández et al. (2022) found that a dedicated organisational unit, alongside strategy and leadership, distinguished the cities that succeeded. The practical value of that finding lies in its actionability, since a unit can be created by administrative act while leadership commitment cannot be mandated. Vignieri and Santoni (2025) contributed the notion of orchestrating capabilities, defined as the capacity to balance institutional, managerial and technological dimensions of interoperability. Their formulation names work that the literature usually presupposes, namely the continuous alignment of technical decisions with institutional constraints during implementation rather than before it.

Knowledge enablers appear in three forms. The first is the association between knowledge management quality and digital government success (Alvarenga et al., 2020; Susanto & Makmur, 2024). Susanto and Makmur (2024) surveyed 243 public sector respondents in Jakarta and found that knowledge management practices influence e-government success while the direct effects of information technology and administrative management were not confirmed, which places knowledge management in a mediating rather than a parallel position. The second is organisational learning as a dynamic capability, flagged by Ongena et al. (2026) as high in impact and low in

development within the Dutch national government. The third is relational knowledge resources, with Vignieri and Santoni (2025) showing that leadership and collaboration complement agile transformation and support public value creation at the service system level. Read together, the three forms sustain a specific claim. Knowledge management operates less as an additional workstream than as a condition on the effectiveness of the others, which is the empirical basis for the model presented in section 4.1.

Relational enablers are clearest in studies adopting a systemic perspective. Nurdin et al. (2022) conducted an interpretive study of two local e-government cases, drawing on interviews with information technology managers, local leaders and staff, and demonstrated that local e-government is sustained through collaboration among actors in a social system that pools resources and reduces financial, political and technical challenges. Their design treats sustainability rather than implementation as the dependent variable, addressing a phase of the trajectory that receives little attention. Kompella (2017) adds an ordering claim, showing that improving the spatial dimension of e-governance allows actors to develop capabilities for information sharing and knowledge management, with better interoperation following. Interoperation appears as an outcome of capability development rather than as its precondition.

User participation resists an instrumental reading. Weigl et al. (2024) describe user-centricity as a double-edged instrument that can increase the burden on users and deepen the digital divide, with structurally rooted conflicts. Djatmiko et al. (2025) supply the complementary evidence, showing that public-private partnerships, digital literacy programmes and emerging technologies improve accessibility while limited digital literacy, infrastructural gaps and institutional barriers restrict adoption among marginalised populations. Participation enables transformation only when the conditions of participation are themselves addressed.

3.3 Four sociotechnical dynamics

The third coding cycle examined how barrier and enabler domains interact along the trajectory of an initiative. De Borba and Brinkhues (2025) reached a compatible conclusion from a narrower corpus, isolating sociotechnical adoption factors as a dimension distinct from governance and from data infrastructure in the adoption of automation within process management. Four dynamics recurred across contexts. Each links at least two domains, and each accounts for outcomes that the separate examination of factors leaves unexplained.

The first dynamic, decoupling between strategy and enacted process (D1), is a divergence between the process represented in strategy documents and the process performed in the operational unit. It arises from the interaction between institutional pressure for conformity (Aswani, 2026) and low explicitation (Lederer & Mahr, 2024; Vilela & Alves, 2025). Its typical form is an organisation that reports successful implementation while the unit continues to work as before, using the new system as a registration layer applied after the fact. Monitoring instruments rarely detect it, since they measure system adoption rather than process change. The dynamic identifies a failure mode that the dominant evaluation apparatus cannot see, and it accounts for a recurring puzzle in the corpus, namely the coexistence of high adoption rates with unchanged service performance.

The second dynamic, digitisation of the procedural legacy (D2), is the encoding of an unrevised process into a technical system. It arises from regulatory rigidity, which blocks redesign, combined with delivery pressure, which blocks postponement. Redundant steps, unnecessary documentary requirements and sequential validations that could run in parallel are transferred into the new system, where they acquire the rigidity of infrastructure. Mergel et al. (2019) drew the conceptual distinction between digitisation and transformation, and this dynamic is its operational content. Its analytical interest lies in an inversion. Instead of enabling revision, the digital system stabilises the process against revision, because altering the process now requires altering the software. Asatiani et al. (2025) describe the resulting condition when they treat technical debt as a managerial problem, and Irani et al. (2023) document its accumulated form across seven levels of legacy complexity.

The third dynamic, erosion of tacit knowledge under automation (D3), is the differential migration of explicit and tacit knowledge during automation. It arises at the junction of the human-cognitive domain, where tacit knowledge resides, and the technological domain, which admits only explicit specification. Melo et al. (2025) documented the mechanism in COBOL modernisation, identifying knowledge retention as a principal risk and tacit knowledge transfer as the hardest component. The dynamic carries a distinctive temporal signature. Its effects are absent at implementation, when modal cases are processed correctly, and appear later, once accumulated non-modal cases exceed the capacity of the workarounds built to absorb them. Because the interval between implementation and manifestation usually exceeds the evaluation horizon of transformation programmes, the link between the automation decision and the later degradation of service quality is seldom established.

The fourth dynamic, asymmetry between technical and institutional integration (D4), is a divergence between the technical capacity to exchange data and the institutional capacity to act on it. It arises from the interaction of the technological-infrastructure and relational-interorganisational domains. Oprea (2025) documented the configuration in Moldova, where technical and data interoperability deficits coexist with entrenched silos, resistance to change and weak inter-agency coordination, with the organisational obstacles identified as central alongside the technical ones. The pathology it produces is an integration infrastructure that remains underused because the arrangements governing data sharing, allocation of responsibility and dispute resolution were never established. Vignieri and Santoni (2025) name the capability that addresses it, namely orchestration across institutional, managerial and technological dimensions, which confirms that the asymmetry is tractable through institutional work rather than through further technical investment.

3.4 Configurational symmetry between barriers and enablers

Comparing Table 2 and Table 3 produced a result that neither typology contains on its own. Most enablers in the corpus correspond to the inverse state of a barrier in the same domain. Leadership commitment and its absence, interoperability and fragmentation, knowledge sharing and knowledge siloing are not independent factors but opposite values of one organisational variable.

The literature usually treats this overlap as a descriptive artefact of how primary studies are written. Reading it substantively changes what a diagnosis is. If barriers and enablers are states of shared variables, a transformation initiative does not confront a set of obstacles to remove and a separate set of facilitators to add. It confronts a set of variables whose configuration determines whether they impede or enable, and the operational question becomes what determines that configuration. Two consequences follow. Methodologically, the frequent appearance of a factor with opposite signs across studies stops being a contradiction and becomes evidence of configurational effects, which is how such divergences were treated in the second coding cycle. Practically, instruments that enumerate obstacles measure the same variable twice and produce diagnostic redundancy, a point developed in section 5.2.

4. DISCUSSION

4.1 The translation mechanism

Barriers, enablers and dynamics condition digital transformation through a single organisational mechanism. Technological investment converts into administrative capacity when the administrative process that receives the technology has been made explicit, when the knowledge it encodes has been articulated across the positions that hold it, and when its encoding preserves the possibility of institutional revision. When any of the three conditions is absent, the same investment produces one of the four dynamics described in section 3.3, and the initiative registers adoption without producing change. The five domains of barriers and enablers do not act on outcomes directly. They act by raising or lowering the three dimensions of the construct defined in section 1.3.

The model that follows from the findings positions three layers and two interfaces. The technological layer holds systems, data, infrastructure and architecture. The institutional layer holds legal mandates, allocation of competences, accountability arrangements and political direction. Between them lies the process layer, made of the sequences of action through which mandates become delivered services. Failures documented in section 3 concentrate at the interfaces rather than inside any layer, which is why remedies aimed at a single layer have produced such uneven results. Figure 1 represents the model and locates each dynamic at the interface where it originates.

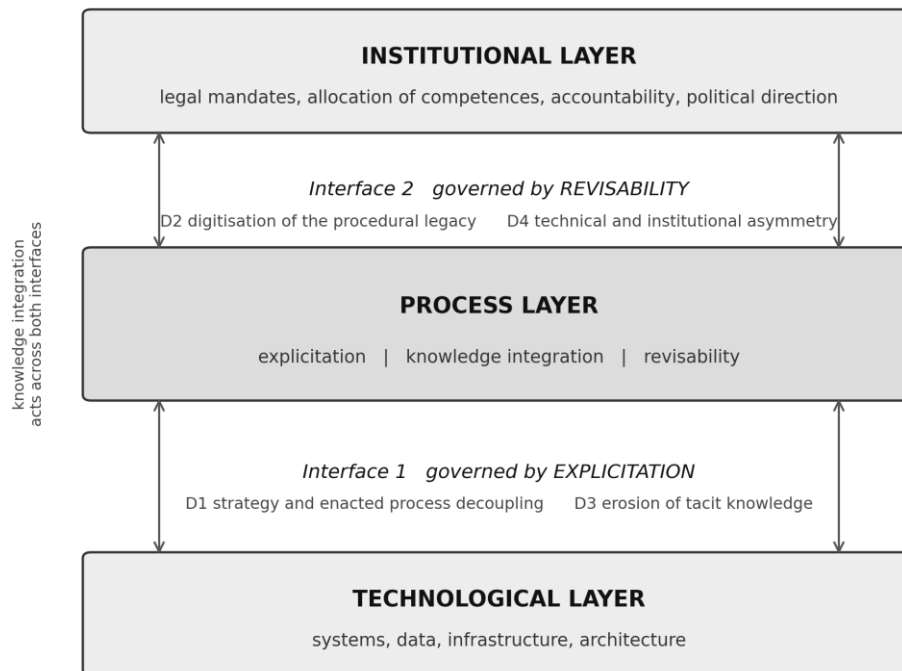


Figure 1 - Knowledge-based process management as a translation mechanism

Source: prepared by the author.

The first interface, between technology and process, is governed by explication. Where the enacted process is documented and understood, technological design can be built upon it. Where it is not, design proceeds from the prescribed representation and produces a system fitted to a process nobody performs. Decoupling, described in D1, is the direct consequence of failure at this interface, and erosion of tacit knowledge, described in D3, is its delayed consequence, since what fails to be made explicit is precisely what fails to migrate.

The second interface, between process and institution, is governed by revisability. Where the institutional framework permits process revision at a cost and pace compatible with technological change, transformation proceeds iteratively and errors remain correctable. Where it does not, the organisation encodes a process it cannot revise, and digitisation of the procedural legacy follows, as does the asymmetry between technical and institutional integration, since integration infrastructure built without corresponding institutional arrangements cannot be adjusted once the arrangements prove absent.

Knowledge integration operates across both interfaces rather than at either one. The knowledge required to design an administrative process is distributed between those who execute it

and those who fix its normative parameters, and design that draws on one position alone will fail at whichever interface the missing position governs.

One prescription follows from the geometry of the model. The conventional sequence of transformation initiatives defines a digital strategy, selects a technology, implements it and adjusts processes afterwards, which places process work after the point at which commitments become expensive to reverse. The model inverts that order. Explication of the enacted process comes first, followed by articulation of the knowledge it encodes, then institutional negotiation of its revision, and only then technological encoding. The argument concerns the sequencing of irreversible commitments rather than the length of planning horizons, and it is testable, since the two sequences predict different distributions of the four dynamics.

4.2 Propositions

Formalising the mechanism as propositions makes it falsifiable and identifies the evidence that would count against it. Table 4 states five propositions, each derived from a documented finding and each specifying an observable implication.

Table 4 - Propositions on knowledge-based process management and transformation outcomes

Proposition	Statement	Empirical anchor	Observable implication
P1	The larger the divergence between prescribed and enacted process at the moment of technological encoding, the higher the probability of decoupling between reported adoption and delivered performance	Aswani (2026); Lederer and Mahr (2024); Vilela and Alves (2025)	Adoption indicators rise while case-level cycle time and rework remain unchanged
P2	Where the cost of institutional revision exceeds the cost of technological encoding, digitisation converts procedural rigidity into infrastructural rigidity	Irani et al. (2023); Asatiani et al. (2025); Mergel et al. (2019)	Post-implementation change requests concentrate on software rather than on norms, and unit cost of change rises over time
P3	Automation migrates explicit knowledge and strips tacit knowledge, so performance loss is deferred and concentrates in non-modal cases	Melo et al. (2025); Alvarenga et al. (2020)	Exception volume and manual workaround grow after the evaluation horizon closes
P4	Technical interoperability without corresponding institutional arrangements produces underused	Oprea (2025); Alshahrani (2025); Vignieri and Santoni (2025)	Data exchange capacity is built while effective exchange volume stays low

Proposition	Statement	Empirical anchor	Observable implication
	integration infrastructure		
P5	Dynamic capabilities affect transformation performance only to the extent that the process layer is revisable	Ongena et al. (2026); Hanum et al. (2026); Panagiotopoulos et al. (2023)	Capability measures predict performance in administrations with high revisability and not in administrations with low revisability

Source: prepared by the author.

P5 deserves comment, since it does explanatory work beyond the other four. Empirical results on dynamic capabilities in government have been inconsistent in a specific way. Panagiotopoulos et al. (2023) found direct and indirect effects on performance in Greek municipalities. Ongena et al. (2026) found a strong association between digital maturity and capabilities in the Dutch national government with no significant mediating effect on performance. Hanum et al. (2026) found no direct effect and full mediation through organisational agility. Read as competing results, the three studies leave the field without a conclusion. Read through P5, they describe administrations with different revisability, and the inconsistency becomes informative. An organisation with high sensing capability that cannot revise its processes will detect environmental change and remain unable to respond, which is what a null coefficient on performance would look like.

4.3 Boundary conditions, divergences and alternative explanations

The mechanism is not expected to operate uniformly, and stating where it should weaken is part of specifying it. Four conditions delimit its scope.

Administrative tradition and process discretion set the first two. The mechanism should be strongest in legalistic traditions, where processes are prescribed by normative instruments and revisability is institutionally constrained, and weaker where administrative procedure is set managerially, so comparative work across the two families would provide a direct test. Discretion works in a related way. High-discretion processes, such as licensing decisions involving technical judgement, carry more tacit knowledge and should exhibit stronger effects of explicitation and of D3. Low-discretion processes, such as document issuance against verifiable criteria, should show weaker effects, and their digitisation should succeed more often on technical grounds alone.

Interdependence and political horizon set the remaining two. Processes confined to one organisation depend little on the relational domain, so D4 should be rare, whereas processes crossing

organisational boundaries, and particularly those crossing levels of government, should exhibit it frequently. Political horizon operates through the feasibility of institutional negotiation. Where policy continuity across electoral cycles is high, the sequence prescribed in section 4.1 is available. Where it is low, organisations face pressure to deliver visible artefacts within a mandate, and D2 becomes the rational local choice even when its aggregate consequences are understood.

Three points of convergence support the model. Vignieri and Santoni (2025) reached a conditional formulation of the relation between transformation and knowledge assets from a case study, and the construct proposed here specifies the conditions they left general. Kompella (2017) found that process innovations stabilise product innovations, which is what the model predicts when revisability is preserved. Niehaves et al. (2013) argued against convergence-based maturity models, and configurational symmetry supplies an independent argument for the same conclusion, since a single maturity trajectory presupposes that the appropriate configuration does not vary with institutional constraint.

Two divergences require acknowledgement. Studies that model leadership as a direct determinant of transformation performance obtain results that the model does not predict, and the reconciliation offered here treats leadership as acting on revisability and knowledge integration rather than on outcomes. That reading is consistent with the enabling-condition role reported by Hanum et al. (2026), yet it remains an interpretation rather than a demonstrated relation. A second divergence concerns work that reports successful transformation without process redesign. Such cases exist, and the model accommodates them only under the low-discretion boundary condition stated in section 4.3. Cases outside that condition would count against the mechanism.

One alternative explanation remains plausible and cannot be discarded with the present design. Resource endowment could account for much of the observed variation, with better-funded administrations achieving both process work and technological quality. The corpus does not permit that alternative to be separated from the mechanism proposed here, since funding and process capability co-vary in most reported cases. Designs that hold resources constant while varying revisability would be required.

5. CONTRIBUTIONS AND IMPLICATIONS

5.1 Theoretical and methodological contribution

The theoretical contribution has three components, each resting on findings reported above rather than on the review as a whole.

The first is conceptual. Knowledge-based process management is defined as a construct with three dimensions that vary independently, namely explicitation, knowledge integration and revisability. Existing instruments collapse these dimensions. Process maturity models fold explicitation into governance and measurement, knowledge management maturity models fold integration into sharing culture, and neither captures revisability. Isolating revisability is the sharper part of the contribution, since D2 shows that it governs whether digitisation reproduces or revises administrative logic, and no established construct measures it.

The second is explanatory. The construct is positioned as the mechanism that translates between the technological and institutional layers of public administration, with the four dynamics located at specific interfaces rather than treated as unrelated failure modes. Explanation replaces enumeration. The barrier literature lists factors, while the model states where in a trajectory each factor becomes binding and which decisions foreclose later correction. P5 illustrates the gain, since it converts an inconsistency in the dynamic capabilities literature into a conditional relation open to test.

The third concerns a boundary condition on the sociotechnical tradition itself. The four dynamics are forms of failed joint optimisation, with strategy optimised against practice, technology against process, explicit knowledge against tacit knowledge and technical integration against institutional integration. What the public sector adds is a subsystem whose rigidity is normatively fixed. Sociotechnical formulations developed in industrial settings assumed that both subsystems were, in principle, redesignable by the organisation. In government the institutional subsystem is frequently redesignable only by actors outside the organisation, which is why joint optimisation fails in a patterned rather than an idiosyncratic way.

Table 5 separates the contributions from the implications that follow from them, a distinction that transformation research often blurs.

Table 5 - Contributions and implications

Type	Statement	Supporting finding
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Type	Statement	Supporting finding
Theoretical	Definition of knowledge-based process management as a three-dimensional construct, with revisability isolated as a dimension absent from existing instruments	Sections 1.3, 3.3 and 3.4
Theoretical	Specification of the construct as a translation mechanism between technological and institutional layers, with four dynamics located at two interfaces	Sections 3.3 and 4.1
Theoretical	Conditional reformulation of the capability-performance relation in the public sector (P5), which reconciles divergent results	Sections 4.2 and 4.3
Methodological	Treatment of barriers and enablers as opposite states of shared variables, reframing sign divergence as configurational evidence	Sections 2.2 and 3.4
Practical	Sequencing criterion for irreversible commitments in transformation initiatives	Section 4.1
Policy	Reframing of digital transformation programmes as instances of policy implementation, with evaluation at process level	Section 5.2

Source: prepared by the author.

Barrier-and-enabler studies routinely report the same factor with opposite signs across settings and treat the divergence as an artefact of context or measurement. Section 3.4 offers an alternative, namely that most reported enablers are the inverse state of a barrier in the same domain, so divergence carries information about configuration. Two operational consequences follow. Instruments should measure the state of a variable rather than count obstacles, which removes the redundancy of asking about resistance to change and change management as separate items. And synthesis across studies should preserve sign divergence as data rather than resolve it by majority, which is how the second coding cycle proceeded here.

5.2 Implications for practice and for public policy

Three implications follow for public managers. Diagnosis comes first. An organisation that lists resistance to change as a barrier and change management as a needed enabler has measured one variable twice, and the useful question concerns what holds that variable in its current state. Instruments built from the three dimensions of the construct would ask instead whether the enacted

process is documented, whether the three knowledge positions were brought into contact during design, and what it would cost to alter the process six months after go-live.

Sequencing comes second. Decisive choices in a transformation initiative are made before procurement, and resources spent on explication and knowledge articulation buy reversibility for everything that follows. The finding of Aswani (2026) that leadership commitment and data governance maturity are the most decisive and least funded components expresses a systematic misallocation across the trajectory, with investment concentrated where deliverables are visible.

Evaluation comes third. The dynamics in D1 and D3 are invisible to indicators of system adoption and to evaluation windows shorter than the interval between implementation and the manifestation of tacit knowledge loss. Programme evaluation should track process-level measures such as case cycle time, exception volume and rework, and should extend past the delivery horizon of the initiative. Exception volume deserves particular attention, since it is the observable trace of P3.

Treating digital transformation initiatives as instances of policy implementation rather than as technological projects makes an established analytical repertoire available. The gap between declared strategy and observed outcome reported by Aswani (2026), the conformity-oriented adoption identified in the same study and the decoupling dynamic of D1 are recognisable as implementation problems concerning discretion, street-level adaptation, coordination and institutional capacity. Digital government research has drawn on that repertoire only partially.

Brazil offers a setting where the model generates specific and testable questions, none of which the present design can answer. The country has built substantial digital government infrastructure, including platform-based delivery and unified digital identity, and performs well in international comparisons of service digitisation. Those comparisons measure the technological layer. Three questions follow about the other two. The first asks how far the digitisation of federal services has been accompanied by process redesign rather than instantiating the dynamic of D2, with Santos (2023) providing an entry point through the analysis of dynamic capabilities in the Brazilian Digital Transformation Strategy without resolving the question at process level. The second concerns federative coordination, since the relational barriers of section 3.1 take a particular form in a federation with pronounced capacity asymmetries across subnational units, where technical integration may advance while institutional integration does not. Bühler and De Borba (2024) document one facet of the problem inside a Brazilian state-owned bank, where competition and

cooperation coexist across branches and superintendencies and shape what knowledge circulates between them, although a state-owned enterprise operates under incentives that core administration does not share. The third concerns process maturity, where the evidence of Vilela and Alves (2025) suggests a distance between transformation ambition and process management capability that merits systematic investigation. Each question maps onto a proposition in Table 4 and could be addressed with administrative data already collected by federal oversight bodies.

FINAL CONSIDERATIONS

The article asked how barriers, enablers and sociotechnical dynamics condition digital transformation in public services when the phenomenon is examined through knowledge-based process management. The answer is that they condition it indirectly, by raising or lowering three properties of the administrative process, namely explicitation, knowledge integration and revisability. Technological investment becomes administrative capacity when those properties are present at the moment of encoding. When they are absent, the same investment produces decoupling, procedural legacy digitisation, erosion of tacit knowledge or integration asymmetry, and the initiative records adoption without producing change.

The four specific objectives were met. Barriers were systematised into five domains in section 3.1 and enablers into five mirrored domains in section 3.2. The dynamics connecting them were characterised in section 3.3. The mechanism was formalised in five propositions in section 4.2, each anchored in documented findings and each stated with an observable implication.

Contributions rest on those results and not beyond them. Knowledge-based process management is defined as a three-dimensional construct, with revisability isolated as a property that existing maturity instruments do not measure. The construct is specified as a translation mechanism whose failure modes occupy identifiable interfaces. The capability-performance relation in the public sector is reformulated conditionally, which reconciles results that the literature has reported as contradictory. Barriers and enablers are treated as opposite states of shared variables, which converts an apparent inconsistency into evidence about configuration.

Three limitations bound these claims. The integrative design supports theoretical synthesis and not statements about how frequently each finding occurs, so no frequency claims were made. The corpus is skewed towards contexts with higher scientific output, which limits transfer to administrations under substantially different resource conditions. Publication bias towards initiatives

with reportable results underrepresents discontinued initiatives, and since the argument concerns conditions of failure, the corpus is weakest precisely where the object is strongest. The propositions are conjectures produced by retroduction and have not been tested. Resource endowment remains a plausible alternative explanation that the corpus cannot separate from the proposed mechanism.

Four lines of future research follow from those limits. Longitudinal designs that observe transformation trajectories from before procurement to well after delivery would test P1 and P3, both of which concern deferred effects that cross-sectional designs cannot detect. Comparative work across legalistic and managerial administrative traditions would test the first boundary condition. Studies that hold resource endowment constant while varying revisability would address the alternative explanation. And the development of an instrument that measures the three dimensions separately would permit P5 to be tested directly, by estimating capability-performance relations in administrations grouped by revisability. Brazilian federal and subnational administrations offer a setting where the second and fourth lines could be pursued with administrative data already available.

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CONFLICT OF INTEREST STATEMENT

The author declares that there is no conflict of interest to report.

DECLARATION ON THE USE OF ARTIFICIAL INTELLIGENCE

The author declares the use of generative artificial intelligence tools during the preparation of this manuscript. The tools were used for screening candidate studies, for assistance in translating, for the structuring of tables and of the figure. Artificial intelligence was not used to generate research data, and empirical results or findings. The research question, the analytical framework, the construct of knowledge-based process management, the propositions and the interpretation of the reviewed literature were formulated and validated by the author, who reviewed and edited every passage produced with tool assistance. Artificial intelligence tools do not meet authorship criteria, are not listed as authors and bear no responsibility for the content. The author assumes full responsibility for the integrity, accuracy and originality of the manuscript.

AUTHOR BIOGRAPHY

Darci de Borba Santos Júnior holds a doctorate in Business Administration. He is a researcher at the Institute for Applied Economic Research (Ipea) and at the Graduate Programme in Public Policy and Development. His work covers digital transformation, public management, process management and data science applied to public policy.

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