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Standard Operating Procedures as Change Infrastructure: A Conceptual Framework for Sustaining Operational Improvement

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Abstract- ***Operational improvement programmes routinely produce measurable gains that disappear within a year. The dominant explanations point to weak leadership commitment, poor tool selection, or an unsupportive culture. This paper proposes a fourth explanation that has been largely overlooked because the object involved is so mundane: gains decay when improvements are never written into the documents that govern daily work. Drawing on routine dynamics, the literature on artifacts and formalization, infrastructure studies, the safety research debate on procedures, and applied research in quality and control systems, the paper reconceptualizes standard operating procedures (SOPs) not as instruments of compliance but as the infrastructure through which change is stored, transmitted, and made contestable. The framework is developed through an integrative synthesis of five theoretical literatures and applied evidence from ten operational domains. A five mechanism framework is developed, comprising inscription, transmission, stabilization, detection, and revision, together with seven enabling conditions, a typology of four procedural regimes, and ten testable propositions. Cross-domain evidence is assembled from industrial and construction safety, aviation safety oversight, healthcare facilities and health system delivery, procurement and supply chain operations, enterprise technology and service management, information security and data governance, audit and financial governance, asset-intensive maintenance and inspection, built environment and infrastructure delivery, and workforce capability. The central claim is that the relationship between procedural formalization and sustained improvement is not monotonic but conditional: formalization sustains improvement only where revision latency is low and authorship sits close to the work. Where revision is slow and authorship is distant, the same formalization accelerates drift and produces compliance without learning. Implications for measurement, management practice, and empirical research are discussed.***

Keywords: standard operating procedures; organizational routines; artifacts; continuous improvement; sustainability of change; formalization; process documentation; quality management systems; operational excellence

I. INTRODUCTION

Most organizations know how to improve a process once. Far fewer know how to keep it improved. A team removes several steps from a workflow, cuts cycle time by a third, and presents the result. Eighteen months later the steps have returned and a new team is chartered to solve the same problem. The improvement was real. Its retention was not.

The literature on continuous improvement has concentrated on how change is generated (Bhuiyan & Baghel, 2005; Imai, 1986; Liker, 2004; Ohno, 1988; Womack & Jones, 1996) and said much less about how it is held. Where sustainability is addressed, the answer is usually commitment, leadership, or culture (Bateman, 2005; Kotter, 1996; Netland & Ferdows, 2016), which locates the cause of decay in states of mind rather than in objects that can be inspected, dated, owned, and revised.

This paper argues that a substantial share of improvement decay is explained by an ordinary and largely ignored object: the standard operating procedure, the document specifying how work in a

task is to be performed. Treated as a compliance artifact, produced for auditors and revised on a calendar, it is a poor instrument for anything. Treated differently, it is the only mechanism most organizations possess for converting a local, temporary, person-dependent improvement into a durable and person-independent one.

The paper therefore reframes SOPs as change infrastructure: the substrate through which an improvement is recorded, distributed, held as a baseline, tested, and revised. Three consequences follow. Durability becomes an observable property of documents rather than an inferred property of attitudes. Failure points in the chain from improvement to retention become measurable. And the contradiction in which formalization appears both as the enemy of adaptation (Benner & Tushman, 2003; Hannan & Freeman, 1984) and as its precondition (Adler & Borys, 1996; Adler et al., 1999; Spear & Bowen, 1999) becomes a conditional relationship moderated by the responsiveness of the procedural system.

The paper defines SOPs as infrastructure, develops a five mechanism framework with the characteristic failure at each mechanism, assembles cross-domain evidence from ten applied literatures, and states ten propositions with candidate measures. Section 2 states the method, Section 3 synthesizes the literature, Section 4 develops the model, Section 5 discusses it, Section 6 sets out implications, and Sections 7 and 8 address limitations and future research.

1.1 The retention problem

Repenning and Sterman (2001, 2002) showed formally how improvement effort is withdrawn once short term results appear, producing a capability trap. Tucker and Edmondson (2003) showed frontline workers resolving process failures individually, restoring service while removing the information needed to change the process permanently. Tucker et al. (2007) found new intensive care practices failing to persist beyond the attention of the implementing team, and Edmondson et al. (2001) traced the same dependency in new surgical technology.

The pattern recurs under local names: unsafe conditions returning after corrective action is signed off (Obogo et al., 2019b, 2019c), failure modes reappearing in infrastructure projects that earlier projects had diagnosed (Nwafor et al., 2019b), negotiated terms eroding once a sourcing initiative closes (Okonkwo et al., 2018a, 2019), and configuration drift after a platform implementation (Badmus et al., 2018; Ladapo et al., 2019). What links them is the absence of a durable record: the improvement existed only as behaviour, and behaviour without an external referent is subject to turnover, memory decay, workload pressure, and reinterpretation (Cohen & Bacdayan, 1994; Levitt & March, 1988).

1.2 Three standard explanations and what they omit

The first is commitment: sponsors withdraw attention or reassign priorities (Kotter, 1996), an effect visible in studies of leadership and operational discipline (Obogo et al., 2019a). It explains regression in every direction equally and cannot account for sustained sponsorship coexisting with reverting processes.

The second is method. Method quality affects the size of the initial gain (Bhuiyan & Baghel, 2005), and implementation research has refined what good deployment looks like, identifying management control practices, managerial behaviour, knowledge transfer, and organizational infrastructure as conditions for success (Camuffo & Gerli, 2018; Galeazzo et al., 2017; Netland et al., 2015; Netland, 2016; Secchi & Camuffo, 2016). It is less obvious why any of this affects the retention of a gain already achieved. Longitudinal work reports effects that fluctuate rather than accumulate (Netland & Ferdows, 2016), reversion is treated as a category of implementation risk (Marodin & Saurin, 2015), and digital deployment inherits whatever process discipline preceded it (Tortorella & Fettermann, 2018).

The third is culture: the organization lacks the norms or psychological safety required for change to become habitual (Edmondson, 1999). This has the most theoretical depth of the three and appears below as an enabling condition, but as a stand alone account it is circular, since sustained improvement is taken as

evidence of the culture that is then used to explain it (Zbaracki, 1998).

All three share an omission. None asks where the improvement is written down, who owns that writing, how quickly it can be changed, and whether anyone performing the work can find it.

1.3 The neglected variable

The neglect is partly a matter of status. Procedure writing is administrative work, delegated to quality departments or technical writers, and appears in organization theory mostly as an example of bureaucratic rigidity. Standards research has begun to correct this, treating standardization as a consequential social process (Brunsson & Jacobsson, 2000; Timmermans & Epstein, 2010), and routine dynamics has restored artifacts to a central position (D'Adderio, 2008, 2011).

Applied research shows the same correction. Audit work treats the corrective action plan as the unit through which a finding either changes practice or recurs (Akomolafe & Agu, 2018; Dogbatsey et al., 2019), safety work treats the hazard register and the observation record as the instruments of durable prevention (Arumosoye & Obriki, 2019; Obriki & Arumosoye, 2019), and service management work treats the documented process as the artifact on which automation is built (Badmus et al., 2019a; Ladapo et al., 2019). The question this paper asks is when a procedural document sustains improvement rather than obstructing it.

II. METHODOLOGY

This paper is conceptual, developing theory through an integrative synthesis of literatures that have addressed procedural documents independently and in different vocabularies. Because the credibility of a synthesis rests on how its corpus was assembled, this section states the approach, the inclusion criteria, the coding procedure, and the evaluative standards applied.

2.1 Research approach

The study follows the conventions of conceptual theory building, in which the contribution is a set of constructs, relationships, and boundary conditions rather than an empirical estimate. The design is integrative, combining literatures that do not cite one another; problem-driven, assembled to explain a documented regularity; and propositional, terminating in falsifiable statements. Integrative synthesis can surface structure that domain-bound research cannot see, and can equally manufacture false convergence by reading heterogeneous findings through one frame. The procedures below make that risk visible rather than eliminating it.

2.2 Corpus construction and inclusion criteria

The theoretical base covers routines, artifacts, formalization, infrastructure, organizational learning, quality management, and safety research on procedures; selection here was purposive and canonical. The applied base covers operational research on documented process in working organizations. Inclusion required a procedural or documented-process artifact treated as an object of analysis rather than as background; a reported operational consequence, whether performance, compliance, recurrence, adoption, or capability; and a work setting specified concretely enough for the procedural layer to be identified.

Applied sources were grouped into ten domains chosen to maximise variance on regulatory intensity, task variability, workforce turnover, and the degree to which work is mediated by software. That spread allows the boundary conditions in Section 5.3 to be stated against observed rather than assumed variation.

2.3 Synthesis procedure

Synthesis proceeded in four passes. Each source was read for its implicit account of how a documented method is created, distributed, held, tested, and changed. These accounts were coded against a provisional mechanism set, revised where a source described a step it did not accommodate; detection and transmission were separated here, having initially been treated as one, because several sources reported organizations that distributed revised documents effectively while retaining no capacity to observe departures from them. The third pass coded the conditions under which mechanisms succeeded or failed, producing the seven enabling conditions in

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Section 4.4. The fourth tested the framework against disconfirming cases, where extensive documentation coexisted with poor retention, which motivated the typology in Section 4.5 and the conditional form of proposition 8.

2.4 Evaluative criteria

The framework is offered against four standards: measurable constructs, falsifiable propositions, stated boundary conditions, and an account that explains the disconfirming cases. The evidence in Section 3.6 is convergent rather than confirmatory, since none of the sources was designed to test these propositions.

III. LITERATURE SYNTHESIS

The synthesis proceeds in two movements: first the theoretical constructs the framework requires, drawn from five literatures that have each addressed part of the problem, then applied evidence from ten operational domains.

3.1 Routines, ostensive and performative

The behavioural theory of the firm established routines and standard operating procedures as the basic units through which organizations act and remember (Cyert & March, 1963; March & Simon, 1958; Nelson & Winter, 1982). Routines store knowledge no individual holds in full, and experimental work established that routinized action is retained as procedural rather than declarative memory, which is part of why it is hard to articulate and easy to lose (Cohen & Bacdayan, 1994). The tradition also treated routines as inertial, which is the origin of the assumption that procedures oppose change.

Feldman and Pentland (2003) separated the ostensive aspect of a routine, its abstract pattern, from its performative aspect, the actions taken by particular people at particular times. Because performance involves interpretation, routines contain an endogenous source of change rather than only of stability (Becker, 2004; Pentland & Feldman, 2005; Pentland & Rueter, 1994). Later work established that routines can be flexible and persistent at once (Howard-Grenville, 2005), operate across levels (Salvato & Rerup, 2011), can source schematic change (Rerup & Feldman, 2011), and pursue consistency and adaptation simultaneously (Turner & Rindova, 2012); Parmigiani and Howard-Grenville (2011) survey the field.

A subsequent body of work examined how patterning is accomplished. Standardization and flexibility are produced by the same micro-level work (Danner-Schroeder & Geiger, 2016), reflective talk and experimental spaces are how participants interrupt and reorient a pattern (Bucher & Langley, 2016; Dittrich et al., 2016), and novelty arises from interdependence between routines rather than within any one of them (Deken et al., 2016; Kremser & Schreyoegg, 2016; Sele & Grand, 2016). Coordinating standardizing with customizing is a skilled accomplishment (Spee et al., 2016), culture shapes which patterns survive integration (Bertels et al., 2016), and timing is itself part of the pattern (Turner & Rindova, 2018). Feldman et al. (2016) summarize the shift away from treating routines as things.

What matters here sits between the two aspects. An SOP is neither the ostensive pattern nor the performance but a third thing: a material representation that fixes the pattern in a form that can travel across shifts, sites, and generations of staff.

3.2 Artifacts and their limits

Pentland and Feldman (2008) warned against designing an artifact and expecting a pattern of action to follow. Artifacts do not determine performance; they participate in it. D'Adderio (2008, 2011) showed how procedural artifacts distribute agency across people, documents, and systems, and Leonardi (2011) and Orlikowski (2000) make parallel arguments for technology. Tyre and Orlikowski (1994) add a temporal qualification that matters here: the opportunity to adapt a method to local conditions is concentrated in a short window after introduction and closes quickly, after which practice congeals whether or not it was captured.

Two implications follow. Writing a procedure never guarantees its performance, so inscription is necessary but not sufficient. And the gap between a written procedure and observed performance is informative. It is a measurable signal, and an organization that suppresses it loses information while one that reads it

gains a diagnostic instrument, which is how safety research treats the reported departure (Arumosoye & Obriki, 2019; Obriki & Arumosoye, 2019).

3.3 Enabling and coercive formalization

Adler and Borys (1996) argued that formalization is not a single variable with a single valence. Coercive formalization forces compliance; enabling formalization helps competent people handle contingencies and is characterized by transparency, flexibility, and repair. The same degree of formalization can therefore produce opposite effects, supported by evidence that tightly specified production systems can also be highly flexible (Adler et al., 1999) and that procedural detail and innovation are complements (Naveh & Erez, 2004). Quality management research distinguishes the control logic of standardization from its learning logic, arguing that programmes fail when the first displaces the second (Hackman & Wageman, 1995; Sitkin et al., 1994).

This paper extends the insight in one respect. Adler and Borys focus on the design characteristics of rules. The framework below adds the dynamics of the system: how fast it revises, who initiates revisions, and how the revision channel couples to detection. A procedure written in an enabling style that cannot be changed for two years will not remain enabling for long.

3.4 Procedures and adaptation in safety research

Safety research has confronted this question more directly, because the consequences of procedural failure are visible. Dekker (2003) contrasted a model in which safety follows from compliance with one in which procedures are inherently underspecified and safe operation depends on skilled adaptation. Hale and Borys (2013) formalized the contrast as rules imposed from above against rules locally constructed and dynamically maintained. Hollnagel (2014) distinguished counting failures from understanding how work ordinarily succeeds, and Grote (2015) argued that rules should allocate uncertainty deliberately rather than eliminate it.

The accident literature supplies the mechanism by which procedural systems fail slowly. Reason (1990, 1997) described latent conditions accumulating in the gap between prescribed and actual work, and Rasmussen (1997) modelled the migration of practice toward the boundary of safe operation under pressure. Vaughan (1996) and Snook (2000) documented the normalization of departures no single actor experienced as a departure, while Perrow (1984) and Leveson (2004) located failure in system design rather than operator conduct. Weick and Roberts (1993) and Weick and Sutcliffe (2007) describe the countervailing capability, Levinthal and Rerup (2006) show mindful attention and routinized action depending on one another, and Amalberti et al. (2005) note the limits of this in ultrasafe systems.

The most recent turn treats the gap between prescribed and actual work as the normal condition of operations. Dekker (2015) argues for designing around the capabilities of the people doing the work rather than around compliance counts, Hollnagel (2017) and Hollnagel et al. (2015) set out how everyday variability can be studied directly, and resilient healthcare research applies the argument where protocol density is highest (Braithwaite et al., 2015). Rae and Provan (2019) distinguish the work that makes operations safe from the documentary work performed to demonstrate safety, which is precisely the divergence this framework predicts when revision latency is high.

Applied research operationalizes the same argument, treating procedural mismatch as a design defect rather than a worker attribute (Obriki & Arumosoye, 2018), walkthrough frequency and coverage as the means by which practice is compared against specification (Obriki & Arumosoye, 2019), and procedural ownership as dissolving at organizational interfaces (Obogo et al., 2019b). The resolution adopted here is that the opposition between adaptation and procedure is false when rules are treated as maintained objects. They conflict only when procedures cannot absorb what adaptation discovers, which is the absorption Spear and Bowen (1999) describe in the Toyota Production System, where rigid specification coexists with continuous improvement because specification makes deviation visible and improvement testable.

3.5 Standardization, quality systems, and the audit trail
Quality management and clinical improvement research have developed detailed accounts of how documented control is created, evidenced, and maintained. Deming (1986) and Ohno (1988) treat the documented standard as the precondition for improvement rather than its opposite, since without a stated method there is nothing to improve from.

Clinical research provides the strongest evidence that documented method changes outcomes and that the document alone is not the mechanism. Checklist interventions reduced surgical mortality and catheter-related infection substantially (Haynes et al., 2009; Pronovost et al., 2006), and Gawande (2009) popularized the argument, but later analysis established that results depended on the programme surrounding the document, including local adaptation, ownership, and the treatment of deviation (Bosk et al., 2009; Dixon-Woods et al., 2011). Berwick (1998) set out the testing logic through which such changes are retained, and Tucker et al. (2007) showed implementation succeeding where staff modify the practice rather than receive it. Dixon-Woods and Pronovost (2016) describe the problem of many hands, where accountability is distributed so widely that no party maintains the standard, and Aveling et al. (2016) examine when individual accountability supports rather than suppresses reporting.

Audit and control research supplies the complementary vocabulary of version, effective date, custodian, change control, and evidence (Akomolafe & Agu, 2018, 2019a). Read as theories of organizational memory rather than as compliance topics, these literatures describe the machinery through which an improvement becomes an institution.

3.6 Evidence across applied domains
None of the studies below was designed to test the propositions advanced here, and most describe their object in the vocabulary of their own field. What the assembly shows is convergence: improvement that is not inscribed does not persist, procedures that cannot be revised are worked around, deviation is informative only against a current baseline, and automation inherits rather than corrects the procedural layer beneath it.

Industrial and construction safety. Risk control research in large energy infrastructure treats the documented control regime as the object that succeeds or fails rather than the behaviour it governs (Obriki & Arumosoye, 2018), and hazard identification research in urban construction treats the currency of the hazard register as the binding constraint on prevention (Obogo et al., 2019c). Three findings map onto the framework: reporting volume responds to the perceived consequences of reporting rather than to the hazard rate (Arumosoye & Obriki, 2019), custodianship dissolves at the interface between principal and subcontractor (Obogo et al., 2019b), and leading indicators function only against a defined expected state, which is why walkthrough coverage matters (Obriki & Arumosoye, 2019). The same literature reports that proliferating procedural content can degrade compliance by exceeding the absorptive capacity of the workforce (Arumosoye & Obriki, 2018), and that culture change is effective only where it terminates in changed working method (Obogo et al., 2019a).

Aviation safety oversight. Safety management system research in aerodromes treats the documented system as the object of oversight, with maturity defined by whether procedures are live rather than whether they exist (Adeyelu, 2019). Predictive compliance monitoring reads aggregated occurrence data as a signal of systemic procedural failure rather than as individual events (Adeyelu, 2018), which is detection at regulator rather than operator level.

Healthcare facilities and health system delivery. Laboratory design and spatial planning research treats the written operational specification as an asset of the same order as the building, since the facility constrains which procedures are performable (Ogbete et al., 2018, 2019). Diagnostic infrastructure and capital delivery models make the same argument for scaling, where replication depends on a documented operating model rather than transferred personnel (Aminu-Ibrahim et al., 2018, 2019), and diagnostic automation assumes standardized acquisition protocols upstream (Ejofodomi et al., 2014). At system level, payment

reform executes through documented operating rules rather than strategic intent (Ilodigwe & Adesemoye, 2019a), and work on why innovation fails to reach populations locates the failure in the delivery system rather than the science (Ilodigwe & Adesemoye, 2019b). Pharmaceutical traceability shows transmission across boundaries, where the procedure travels with the product through parties sharing no management system (Aneke & Adesemoye, 2019).

Procurement and supply chain operations. Procurement improvements are unusually easy to measure and unusually prone to reversion. Sourcing research in oil and gas documents savings that erode as buying reverts to prior patterns (Okonkwo et al., 2018a), and vendor governance research treats documented governance as what holds negotiated terms in place (Okonkwo et al., 2019). Availability and uptime research shows stabilization directly, since availability depends on standing replenishment rules rather than expediting (Okonkwo et al., 2018b), and risk models for EPC projects treat documented escalation paths as the difference between a managed and an unmanaged disruption (Agbabiaka et al., 2019). Enterprise technology and service management. Directory and identity management research reports reliability depending on documented administrative procedure rather than platform capability, with offline assessment repeatedly surfacing undocumented configuration as the proximate risk (Ladapo et al., 2018, 2019; Oshoba et al., 2019). Cloud architecture and allocation research assumes a specified operating envelope against which decisions are evaluated (Ahmed & Odejobi, 2018a, 2018b; Ahmed et al., 2019; Odejobi et al., 2019), and multi-tenant research defines expected behaviour under concurrency as a documented baseline before it can be measured (Odejobi & Ahmed, 2018b). Platform engineering makes the automation observation explicit: pipelines formalize whatever release process exists (Badmus et al., 2018), data integration inherits upstream definitions (Badmus et al., 2019a), and governance in regulated environments is constituted by documented control rather than tooling (Badmus et al., 2019b). Renewable energy modelling shows the same dependency, since an estimate is only as stable as the measurement procedure feeding it (Odejobi & Ahmed, 2018a).

Information security and data governance. Data protection governance research treats legal and ethical risk as carried by documented controls rather than by intent (Mbonu et al., 2018), and comparative work describes multiple authoritative specifications applying at once across jurisdictions (Mbonu et al., 2019a). Log analytics and automated incident response shorten the detection cycle, since deviation from an expected state is identified continuously rather than at audit (Mbonu et al., 2019b). Insider threat classification depends on a specification of normal activity (Akeju et al., 2018), security audit frameworks define the documented control as the object under examination (Dosunmu & Ogundele, 2019), and risk-based assurance links data availability to maintenance of that control set (Fadayomi et al., 2019).

Audit, internal control, and financial governance. Audit research is research on detection conducted by a profession that has institutionalized it. Audit quality research links effectiveness to risk assessment against defined control expectations (Akomolafe & Agu, 2018), risk-based internal control research defines the control as a documented expected behaviour (Akomolafe & Agu, 2019a), and data-driven risk evaluation extends this to institutions where the control environment is itself unstable (Akomolafe & Agu, 2019b, 2019c). Public sector research documents drift at scale, where reporting practice and statutory requirement diverge (Dogbatsey & Ebhojie, 2018), while reconciliation and workflow redesign shows inscription operating on control procedures themselves (Dogbatsey et al., 2019). Strategic accounting research treats documented systems as the carrier of transparency (Bola-Sadipe et al., 2019), financial analytics treats the documented decision process as the unit through which analysis becomes action (Lawal & Oduleye, 2018a, 2019b), and tax and transfer pricing research shows the version integrity problem across jurisdictions (Anichukwueze et al., 2019; Lawal & Oduleye, 2018b, 2019a).

Asset-intensive operations, maintenance, and inspection. Maintenance is where stabilization is most legible, since equipment condition records independently whether practice changed. Predictive maintenance research in power infrastructure treats the maintenance regime as a standing specification that

either is or is not executed (Adaramola et al., 2018), and reliability engineering defines failure analysis as comparison against a specified expectation (Gideon et al., 2019). UAV-based line inspection changes what can be observed but delivers value only where the protocol and its integration into the maintenance programme are defined (Dagodzo, 2018a, 2018b), and corrosion research shows the same for protective regimes, which are documents before they are activities (Atta et al., 2018). Optimization research in electrical and thermal systems assumes standardized operating parameters as its baseline (Amayo, 2017; Oshevire et al., 2017; Sunday et al., 2019), and telecommunications research ties network performance to standardized installation practice (Amayo & Popoola, 2017). Distributed energy research makes the point about novelty: integrating solar and hybrid installations requires new procedural specification rather than new equipment alone (Shittu et al., 2019; Sunday & Omoegun, 2018, 2019).

Built environment and infrastructure delivery. Work on public infrastructure delivery treats documented process as the determinant of efficiency across projects that dissolve on completion (Nwafor et al., 2019b), and urban resilience research treats design standards as how lessons from flood events persist (Nwafor et al., 2019a). Morphology and envelope optimization research shows accumulated practice encoded in building convention, some well adapted and some merely inherited (Nwafor et al., 2018a, 2018b), evaluation of local materials shows specification governing adoption at scale (Nwafor et al., 2019c), and housing affordability research locates outcomes in the procedural environment rather than design choices alone (Gil-Ozoudeh et al., 2018). Contaminant modelling in remediation extends the argument to monitoring, since predictive models depend on standardized sampling (Azeez & Badmus, 2018; Badmus & Olamide, 2019; Lamidi & Olamide, 2018).

Workforce capability and training. Pedagogical research finds instructional strategy effective only where specified concretely enough to be reproduced by teachers who did not design it (Bobga et al., 2018), professional development research finds competence dependent on structured development rather than experience alone (Yeboah et al., 2019), and entrepreneurship education research reaches the same conclusion outside formal employment (Michael & Ogunsola, 2019). Instruction decays unless the method it teaches is itself maintained.

3.7 Convergent patterns

Each literature has independently identified part of one structure: safety research has developed detection furthest, quality and clinical improvement research the revision loop, service management research the dependency of automation on procedural clarity, and audit research the comparison of practice against specification. What has been missing is the assembly, and with it the recognition that these are aspects of one cycle rather than four separate findings.

IV. THE CONCEPTUAL MODEL

This section defines the construct, distinguishes it from the compliance view, specifies five mechanisms and their failure modes, identifies seven conditions that determine whether the mechanisms operate, derives a typology, and states ten propositions.

4.1 Definition

Standard operating procedures are defined here as the authoritative, durable, accessible representations of how specific work is currently to be performed, held by an identified custodian and subject to a defined revision process. Authoritative means one version governs, so disputes about correct practice have a referent; durable means it survives the departure of those who created it; accessible means it can be reached at the moment the work is done; and a defined revision process means a known route to change with someone responsible for that route.

The term change infrastructure is used deliberately. Infrastructure, as developed by Star and Ruhleder (1996) and Star (1999), is a relational property: something becomes infrastructure when it is embedded in practice, learned as part of membership, built on an installed base, and invisible in use but visible on breakdown. Bowker and Star (1999) add that standardization systems carry consequential decisions that become naturalized. Procedural documents fit exactly: unremarked when they work,

conspicuous when they fail, and constraining what can be changed next. This explains why platform implementations succeed or fail on the procedural layer beneath them (Badmus et al., 2018, 2019a; Ladapo et al., 2019). Automation does not create procedural clarity; it exposes its absence.

4.2 Two views of the same object

Table 1 contrasts the compliance view with the infrastructural view. The contrast is not about the documents, which may be textually identical under either view, but about purpose, ownership, revision dynamics, and the interpretation of deviation.

Table 1. The compliance view and the infrastructural view of standard operating procedures.

Dimension	SOP as compliance artifact	SOP as change infrastructure
Primary purpose	Demonstrate control to external parties	Retain and distribute improvement internally
Audience	Auditors, regulators, legal function	The person performing the task
Author	Quality or technical writing function	Operators with editorial support
Revision trigger	Calendar cycle or audit finding	Any validated improvement or observed deviation
Revision latency	Months to years	Days to weeks
Meaning of deviation	Non-conformance, a disciplinary matter	Signal, an input to the next revision
Success measure	Audit pass rate, document completeness	Currency, retention of gains, revision throughput
Failure mode	Drift between document and practice	Churn, over-documentation, version conflict

The final row matters. The infrastructural view has its own pathologies: excessive documentation of trivial tasks, instability from over-frequent revision, and competing versions when change control weakens. These are addressed in Section 5.3.

4.3 Five mechanisms

Five mechanisms connect a local improvement to a sustained organizational one. They are sequential and cyclical, and failure at any point breaks the chain regardless of performance at the others.

Figure 1. The retention cycle. Each mechanism is a necessary condition for the next, and the output of revision returns to inscription.

	Mechanism	Function
1	Inscription	The validated change is written into the document that governs the task.
2	Transmission	The revised document reaches every person who performs the task, including newcomers.
3	Stabilization	The new method becomes the baseline and survives turnover, absence and workload peaks.
4	Detection	Departures from the baseline become visible and are reported rather than absorbed.
5	Revision	The signal is assessed and the document is changed, or the deviation is explicitly rejected.

Inscription. This is the act of writing a validated change into the governing document. It fails in three ways: the improvement is recorded in a project artifact with no authority over daily work, or at the wrong level of specificity so the essential detail is lost, or not at all because the team's charter ended at demonstration of results. The third case is the most common and reflects a governance choice rather than an oversight, since projects are closed on measured effect rather than on documentary change. Reconciliation and workflow redesign research reports the same, with validated control changes never written back into the procedures staff follow (Dogbatsey et al., 2019).

Transmission. This is the movement of the inscribed change to the people who perform the work, since a revised document that is not read has the same effect as no revision. It depends on findability, notification, and induction, meaning whether new joiners receive the current version rather than a predecessor's habits. Where induction runs through informal apprenticeship alone, the organization transmits practice as it was when the trainer learned it, reintroducing superseded methods (Cohen & Bacdayan, 1994). Professional development research reports the same, with competence transferring through structured development rather than exposure (Bobga et al., 2018; Yeboah et al., 2019).

Stabilization. This is the establishment of the new method as the reference state, making the improvement independent of those who produced it, which is the classical contribution of routines as organizational memory (Argote & Miron-Spektor, 2011; Levitt & March, 1988; Nelson & Winter, 1982). It is often mistaken for rigidity, but a baseline is a reference point rather than a prohibition, and its value is that it makes subsequent change measurable: without a current statement of the present method, any later change starts from an unknown point and improvement cannot be told from oscillation (Okonkwo et al., 2018b).

Detection. This is the mechanism by which departures from the baseline become visible, and the one most damaged by the compliance view, since deviation that carries sanction is concealed (Arumosoye & Obriki, 2019). It depends on the quality of the baseline. An out of date SOP generates continuous, meaningless deviation and trains everyone to ignore the signal, which is how departures become normalized without anyone deciding to depart (Rasmussen, 1997; Vaughan, 1996), while a vague SOP generates no detectable deviation at all. Detection capacity is therefore a function of procedural currency and granularity rather than of vigilance (Mbonu et al., 2019b; Obriki & Arumosoye, 2019).

Revision. A detected deviation must produce one of two outcomes: the document changes, or the deviation is rejected with a stated reason and the baseline reasserted. The destructive case is the third, where the deviation is neither absorbed nor rejected but persists alongside a document that no longer describes the work. This is drift, and once established the document loses authority for all purposes. Revision fails for structural rather than attitudinal reasons: the cost of changing a controlled document, in approvals, waiting time, and friction, frequently exceeds the cost of working around it, and when that inequality holds the organization has priced itself out of its own learning mechanism. Corrective action research reaches the same conclusion, finding recurrence determined by the speed and quality of the documentary change rather than by the sophistication of the analysis (Akomolafe & Agu, 2018; Dogbatsey et al., 2019).

The loop as a whole. The output of revision is the input to inscription. The cycle resembles the deliberate learning processes described by Zollo and Winter (2002) and the iterative testing logic of Berwick (1998). What the framework adds is the artifact through which articulation and codification are actually carried, and the identification of latency in that artifact as the binding constraint.

4.4 Enabling conditions

Seven conditions determine whether the mechanisms operate. They function as moderators rather than as mechanisms in their own right.

Authorship proximity. The distance, organizational and physical, between those who write the procedure and those who perform it. Proximity improves accuracy, increases legitimacy, and lowers the

threshold for proposing changes, an effect clinical implementation research reports directly (Dixon-Woods et al., 2011; Tucker et al., 2007).

Revision latency. The time between identifying a needed change and releasing the revised document. Latency is the most consequential variable in the framework, because it governs the price of the workaround relative to the price of the change, and because the window in which adaptation is likely closes quickly (Tyre & Orlikowski, 1994).

Custodianship. Whether a named person is accountable for the currency of each document. Unowned documents age without anyone experiencing the ageing as a failure, and ownership dissolves at organizational boundaries (Nwafor et al., 2019b; Obogo et al., 2019b).

Accessibility. Whether the current version can be retrieved at the point and moment of work. A procedure in a system three floors away is functionally absent.

Version integrity. Whether one and only one version is authoritative. Local copies and departmental variants fragment the baseline and disable detection, which identity and configuration research treats as a first-order control problem (Ladapo et al., 2018; Mbonu et al., 2019a; Oshoba et al., 2019).

Psychological safety. Whether reporting a deviation is safe (Edmondson, 1999). Detection depends on voluntary disclosure of the gap between specification and practice, which under the compliance view is an admission of non-conformance.

Granularity fit. Whether the level of detail matches the variability of the task. Over-specification of variable work produces unavoidable deviation and cynicism; under-specification of repeatable work produces undetectable variation (Grote, 2015).

4.5 A typology of procedural regimes

Combining the depth of formalization with the responsiveness of the revision system yields four regimes, shown in Figure 2. The ossified and generative regimes are frequently confused, because they look identical in a document count, and movement from the first to the second requires investment in the revision channel rather than deregulation. Artisanal organizations often outperform ossified ones in adaptability while underperforming them in retention, which is why comparative studies of formalization produce inconsistent results.

Figure 2. Four procedural regimes. Only the generative regime constitutes change infrastructure.

	Low formalization	High formalization
High revision responsiveness	Artisanal. Practice adapts quickly but little is written down. Gains leave with the people who made them. Failure mode: no accumulation.	Generative. Procedures are detailed, current, owned and quickly revised. Deviation is treated as input. Failure mode: revision churn.
Low revision responsiveness	Latent. Documents exist somewhere, describe little, and change rarely. Work runs on memory. Failure mode: invisible variation.	Ossified. Extensive procedures that are costly to change. Practice moves on without them. Failure mode: drift and compliance theatre.

4.6 Propositions

Proposition 1. The proportion of an operational improvement retained at twelve months increases with

the completeness with which the change was inscribed into the document governing the affected task.

Proposition 2. Inscription without transmission produces retention rates comparable to no inscription. The effect of inscription on retention is mediated by the accessibility of the revised document at the point of work.

Proposition 3. The retention benefit of inscription increases with workforce turnover and with task interdependence, because both raise the cost of relying on individually held knowledge.

Proposition 4. The rate at which deviations are detected and reported increases with procedural currency and declines when the governing document is materially out of date, because stale baselines produce indiscriminate deviation and desensitize observers.

Proposition 5. As revision latency increases, operators substitute private workarounds for procedural change, and the gap between documented and enacted practice widens. Drift is a function of relative cost, not of attitude.

Proposition 6. Procedures authored with substantive participation by those who perform the work exhibit lower drift, higher voluntary consultation, and higher rates of operator-initiated revision than procedures authored remotely.

Proposition 7. Where deviation carries sanction and revision latency is high, organizations exhibit high measured compliance together with high unmeasured deviation. Audit performance and actual conformance decouple.

Proposition 8. The relationship between depth of formalization and sustained improvement is conditional on revision responsiveness, positive when responsiveness is high and negative when it is low. This interaction, rather than a main effect, accounts for inconsistent findings in the formalization literature.

Proposition 9. Digital procedural systems that lower the transaction cost of versioning shorten revision latency and increase retention, but only where a single authoritative version is preserved. Where digitization multiplies uncontrolled copies, it reduces retention by degrading detection.

Proposition 10. Organizations that manage procedural currency, revision latency, and authorship distribution as standing performance measures retain a higher proportion of improvement gains than organizations that manage procedures solely through audit compliance.

V. DISCUSSION

5.1 What the framework explains

The account offered here is neither motivational nor cultural. Organizations lose gains because the gains were never transferred from behaviour into an artifact capable of carrying them, or because that artifact cannot be changed quickly enough to remain true. Both failures are observable in document metadata, so the explanation can be checked rather than inferred.

Three puzzles become tractable. Programmes with sustained sponsorship still revert because sponsorship funds the generation of change and rarely the revision channel. Organizations with extensive documentation often perform worst on adaptability because volume and responsiveness are independent properties, and the ossified regime has the first without the second. Technology implementations fail to deliver process improvement because the platform formalizes the process definition already held (Badmus et al., 2018, 2019a). The framework also reinterprets a familiar complaint: when operators say procedures do not reflect the work, that is a measurement of drift and of the latency that produced it.

5.2 Reconciling formalization and adaptation

Formalization appears in the literature both as a source of inertia and as the precondition for disciplined improvement, and both claims have empirical support, which suggests a conditional relationship rather than a mistaken literature. The framework locates the moderator in the dynamics of the system rather than in the design of individual rules. Where latency is low and authorship sits close to the work, specification is an instrument of learning: deviation becomes legible, improvement testable against a known baseline, and

each improvement distributable to everyone performing the task. Where latency is high and authorship remote, the identical specification becomes an obstacle: operators adapt privately because adaptation is cheaper than revision, documented and enacted practice separate, and the organization loses both the compliance it thought it bought and the learning it never designed for.

Studies that operationalize formalization as document count or perceived rule intensity therefore measure a variable whose sign depends on an unmeasured moderator, which would explain why their findings do not aggregate; including revision latency and authorship distribution as covariates should reduce that heterogeneity.

5.3 Boundary conditions

Five boundaries should be stated.

Task variability. The argument applies most strongly to work with recurring structure. For novel or highly creative work the governing artifact cannot specify method and at most specifies constraints, checkpoints, and decision rights, and attempting step-level inscription produces the over-specification pathology noted in Section 4.4.

Regulatory intensity. Where changes require external approval, revision latency is partly exogenous (Lawal & Oduleye, 2018b; Mbonu et al., 2019a). The lever then shifts from eliminating latency to separating the regulated core of a document from the remainder so the latter can move quickly.

Environmental tempo. Where the environment changes faster than the revision cycle can track, procedural infrastructure becomes a liability regardless of design, which is the situation the inertia literature describes and which frames procedural investment as a commitment to exploitation at the expense of exploration (Benner & Tushman, 2003; Hannan & Freeman, 1984; March, 1991).

Substitution by systems of record. Where a process is enforced by software rather than described in a document, inscription occurs in configuration rather than text (Badmus et al., 2018; Oshoba et al., 2019). The mechanisms hold, but custodianship, version integrity, and latency become properties of the system's change management process, and accessibility is satisfied differently, since the specification is enacted rather than read.

The churn pathology. Very low revision latency has its own failure mode. If documents change faster than people can absorb them, the baseline ceases to be stable and stabilization fails (Arumosoye & Obriki, 2018). The relationship between revision frequency and retention is therefore expected to be curvilinear, with an optimum set by the learning cycle of the workforce rather than by the capability of the document system.

VI. IMPLICATIONS

6.1 Implications for theory

For routine dynamics, the framework gives artifacts a role that is neither determinative nor incidental: the document does not fix performance, but it determines what can be recognized as deviation and therefore what enters the organization as learning, which makes it consequential through detection rather than through control of action. For organizational learning and dynamic capabilities, it identifies a measurable constraint on codification. Deliberate learning requires articulation and codification (Zollo & Winter, 2002), and continuous improvement operates as an infrastructure supporting dynamic capability rather than as a set of projects (Anand et al., 2009), but codification has a cost structure and a latency that have gone largely unexamined. For the formalization literature, the contribution is the conditional form in Section 5.2, consistent with evidence that specification and flexibility coexist (Adler et al., 1999; Naveh & Erez, 2004); for infrastructure studies, it extends the invisibility-and-breakdown argument to an artifact usually read as bureaucratic residue.

6.2 Implications for practice

Eight design principles follow, stated as instructions to those responsible for improvement programmes.

1. Close improvements with a document, not a presentation. Define the completion of any improvement project as the release of the

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revised procedure, and refuse closure without it.

2. Name a custodian for every procedure. Accountability for currency should sit with an individual who performs or supervises the work, not with a central function.
3. Make revision cheaper than the workaround. Measure the full cost in time and approvals of changing a document, and treat any figure above a few days as a defect rather than as prudence.
4. Write procedures where the work happens. Draft and verify at the workplace with the people performing the task, and treat remote authorship as an exception requiring justification.
5. Keep one authoritative version. Eliminate local copies and personal variants, and make the current version reachable in seconds at the point of work.
6. Treat deviation as data. Separate deviation reporting from performance evaluation, and require every report to produce either a revision or a documented rejection.
7. Specify to the level the task requires. Specify outcomes, checkpoints, and the few steps where variation is consequential, rather than every action.
8. Audit currency alongside compliance. An audit that verifies conformance to an obsolete document certifies the wrong thing.

6.3 Implications for measurement

Table 2 sets out candidate operationalizations. Most rely on data document control systems already produce but rarely analyse, and several have close analogues in existing practice in audit, safety, and service management (Akomolafe & Agu, 2018; Dosunmu & Ogundele, 2019; Obriki & Arumosoye, 2019).

Table 2. Candidate measures for the framework's principal constructs.

Construct	Indicator	Source
Procedural currency	Share of active procedures revised within their stated review interval	Document control register
Revision latency	Median days from validated improvement to release of the revised document	Change records matched to project records
Inscription completeness	Share of closed improvement projects with a corresponding document revision	Project closure audit
Authorship proximity	Share of revisions initiated or co-authored by task performers	Revision metadata
Drift	Step level correspondence between documented and observed practice	Direct observation of task execution
Detection rate	Reported deviations per thousand task cycles	Deviation reporting system
Retention of gains	Share of measured improvement still present at six and twelve months	Process performance data
Version integrity	Number of uncontrolled copies or variants found in circulation	Workplace survey or audit sweep

VII. LIMITATIONS

This is a conceptual paper and offers no empirical test. The causal ordering it asserts, in which inscription precedes retention, is plausible but reversible: organizations that retain gains well may simply document well for unrelated reasons, with both driven by managerial capability, which the designs in Section 8 would disentangle.

The cross-domain evidence carries its own limitation. It is assembled from studies not designed to test these propositions, using heterogeneous methods, many of them conceptual or review-based, so the convergence is suggestive rather than confirmatory and the assembly is vulnerable to selection in favour of studies that foreground documented process.

The framework also privileges written procedure over other retention mechanisms. Physical redesign, software constraint, and job redesign retain improvements without documents, in some cases more robustly, since a removed machine cannot be reintroduced by habit (Nwafor et al., 2018b; Ogbete et al., 2018), so a complete theory would treat the SOP as one member of a family of stabilizing artifacts. Finally, the framework is drawn from manufacturing, construction, healthcare, regulated, and infrastructure contexts; transfer to knowledge work is plausible but untested, and granularity fit suggests it will be uneven.

VIII. FUTURE RESEARCH

Several designs follow from the propositions and measures above. A longitudinal study matching improvement projects to document revisions would test propositions 1 and 2, with retention measured at fixed intervals. A comparison across units of one organization, holding culture and leadership approximately constant while exploiting variation in revision latency, would test proposition 8, and a comparison across regulated and unregulated units would isolate exogenous latency. Observation of drift would establish decay curves for procedural accuracy, and tracing how a proposed change moves from the floor to release would identify the transaction costs the framework treats as binding.

Three further avenues are worth naming. Procedural content continues to migrate into service platforms and automated execution (Badmus et al., 2018; Ladapo et al., 2019; Mbonu et al., 2019b), and the effect should depend on whether migration reduces latency while preserving version integrity. The curvilinear relationship in Section 5.3 implies an optimum revision frequency that shifts with training intensity, turnover, and task complexity. And substitution among stabilizing artifacts remains unexamined. A systematic review coded against the five mechanisms would establish whether the convergence reported here survives a less purposive corpus.

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