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Standardization of Reporting and Decision Workflows: A Framework for Improving Efficiency, Data Quality, and Management Visibility

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Abstract
Organizations routinely treat process management and management reporting as separate concerns, assigning them to different functions, different tooling and different governance cycles. This paper argues that they are two faces of a single problem: making decision-relevant information explicit, consistent and traceable. Managed apart, organizations standardize the process without standardizing the decision inside it, and standardize the report without standardizing the definitions beneath it. The result is a process that is repeatable but whose outcomes are not, and a report that is punctual but whose numbers cannot be reconciled. The paper develops the Reporting and Decision Workflow Standardization (RDWS) framework, which treats decision workflows and reporting workflows as one standardization object organized into four interdependent layers: definition, decision, workflow and visibility. Each layer is specified by its standardization object, its evidencing artefact and its characteristic failure mode. The framework's central claim is a coupling argument: each layer constrains the layers above it, and the decision layer is both the layer most often skipped and the layer whose absence most reliably undermines later specification and automation work. The paper contributes the four-layer framework, a twelve-criterion assessment rubric rated across four levels, a five-level maturity progression, a standardization-degree heuristic, and eight propositions for empirical evaluation. It is a conceptual contribution developed by structured synthesis of published literature and professional practice; it reports no primary data and has not been empirically validated.

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1. Introduction

Two literatures address the same organizational failure from opposite ends and rarely meet. Business process management asks how work flows, and has produced evidence that standardizing that flow improves performance (Münstermann *et al*., 2010; Wüllenweber *et al*., 2008). Business intelligence and performance measurement ask what management sees, and have produced an equally substantial body of work on the dimensions along which information can be good or bad and on the conditions under which reporting infrastructure succeeds (Wang & Strong, 1996; Wixom & Watson, 2001). Both concern one object: decision-relevant information, made explicit, kept consistent, and traceable to the facts and rules that produced it.

The separation is reinforced by how each field consolidated. Business process management became a management discipline with articulated design principles rather than a modelling technique (vom Brocke *et al*., 2014), and the benefits attributed to process orientation have been appraised across an accumulated body of empirical work (Kohlbacher, 2010). Reporting followed its own path from data warehousing through business intelligence to analytics, acquiring a standard framing of that evolution (Chen *et al*., 2012) and reviews of whether investment converts into realized value (Trieu, 2017). Neither consolidation obliged the other to define its terms, and neither took the decision as its unit of analysis.

Because the two are managed separately, the seam between them is where organizational effort leaks. A process improvement program documents the sequence of tasks and leaves untouched the criterion an assessor applies where the outcome is actually determined; a reporting program rebuilds the production pipeline and leaves untouched what a case is or when it counts as completed. The symptoms are familiar: a process that passes conformance review while its outcomes vary by assessor; two reports each internally defensible and mutually irreconcilable; a management pack that arrives on time and cannot survive a question about its own numbers.

The argument advanced here is that these are not two problems but one, to be addressed as a single standardization object with a defined internal structure: the Reporting and Decision Workflow Standardization (RDWS) framework, comprising four interdependent layers: definition, decision, workflow and visibility, each with a standardization object, an evidencing artefact and a characteristic failure mode, together with an assessment rubric, a maturity progression, a degree heuristic, and propositions a later study could evaluate.

The paper makes four contributions: it unifies process and reporting standardization into one layered construct; it makes explicit a coupling argument, in which each layer constrains the layer above it; it introduces *determinacy*: the degree to which a decision point produces the same outcome from the same inputs, as the diagnostic property of the decision layer; and it converts the framework into usable instruments. A fifth, subsidiary contribution is a clustered survey of how the same standardization problem presents across a dozen applied domains, offered as illustration of the problem's generality rather than as evidential support for the framework.

Section 2 reviews the contributing literatures: process standardization, modelling quality, improvement method, performance measurement and governance, compliance, knowledge-intensive work, decision modelling, information quality, business intelligence, benefits realization, and the limits of codification, and states the gap between them; Section 3 surveys how the standardization problem appears across financial reporting and audit, financial planning, procurement, supply chain, information security, enterprise platforms, regulated and public-sector reporting, operational technology, analytics, small-firm improvement, program governance and safety management, drawing on applied and practitioner literature flagged there as illustrative rather than evidential; Section 4 sets out the method; Section 5 develops the framework, the coupling argument and the instruments; Section 6 walks the framework through a hypothetical illustration in a document-heavy casework setting; Section 7 discusses practice implications, cross-domain generality and a validation agenda; Section 8 states limitations; Section 9 concludes.

2. Background and Related Literature

2.1. Process standardization: strong on flow, quiet on the decision

The reengineering tradition established that information technology's contribution to performance runs through the redesign of work rather than the automation of existing tasks (Davenport & Short, 1990; Hammer, 1990), and enterprise systems subsequently forced organizations to decide how much commonality to impose on themselves (Davenport, 1998). Modern business process management consolidates this into a management lifecycle (Dumas *et al*., 2018) supported by a capability view of the organizational elements it requires (Rosemann & vom Brocke, 2014) and by evidence that program success is contingent rather than automatic (Trkman, 2010).

The empirical case for standardization is reasonably developed. Münstermann *et al*. (2010) evaluated the performance impact of standardizing the recruitment process and provide the core empirical anchor for the standardization–performance relationship; a companion case study reported a reduction in time-to-hire from 92 to 69 days and a cut of approximately 30 per cent in overall recruiting process cost, with improved applicant data quality and process transparency (Muenstermann *et al*., 2010). Wüllenweber *et al*. (2008) surveyed 335 business process outsourcing ventures across 215 German banks and, using partial least squares structural equation modelling, found that standardization improved outsourcing success both directly and indirectly through improved monitoring and governance. The same literature supplies its own limits. Schäfermeyer *et al*. (2012), surveying 255 business process management experts, found that higher standardization effort cannot compensate for higher process complexity, and Romero *et al*. (2015) that full unification is often impractical for cultural, legal or operational reasons. Any framework implying that more is always better misreads this evidence.

Standardization is also studied as a coordination decision rather than a by-product of system implementation. Tregear (2015) framed it as a governed trade-off between "the conflicting demands of standardization for global efficiency versus variation for local effectiveness", the unit of decision being a single process in a single location, with event-log evidence used inside enterprise system projects to ground the decision in observed rather than stated behavior (Fleig *et al*., 2018). Shared services is where it is most explicitly institutionalized: Richter and Brühl (2017), synthesizing 83 peer-reviewed works into four research perspectives and 17 major research domains, reported that more than 75 per cent of Fortune 500 companies have established models of shared services, while calling the evidence base fragmented rather than cumulative.

Standardization across sites has also been treated as a coordination strategy in its own right, examined through case evidence rather than surveys alone (Manrodt & Vitasek, 2004). Institutionalized in shared services it yields a hybrid form, support work being retained in-house while relocated to specialized facilities combining market-style, customer-centered operation with internal management oversight (Herbert & Seal, 2012). Such centers fall into distinguishable configurations with differing performance implications, which shift over the implementation lifecycle (Richter, 2021), and the multidivisional implementation evidence has been synthesized rather than left to accumulate (Richter & Brühl, 2021). Davenport (2005) pressed the logic furthest: standardized process descriptions are what make processes tradable at all, which makes definitional stability, not workflow uniformity, the deeper commodity.

Outcomes are also conditioned from outside the process. There is no single correct configuration of business process management, the appropriate one being contingent on characteristics such as uncertainty and interdependence (Zelt *et al*., 2019); a supportive culture is measurable through a validated instrument (Schmiedel *et al*., 2014); and Kohlbacher and Reijers (2013) found in Austrian manufacturing companies that process performance measurement, process-oriented structure, continuous improvement method application and "in particular" a process-aligned culture are "significantly and positively associated with organizational performance". Standard operating procedures have separately been argued to serve as deliberate management instruments in small firms (Eyetsemitan *et al*., 2022), from a venue this paper has not independently assessed and used for framing only.

What the literature under-treats is the decision. Its unit of analysis is the flow of activity: sequence, handover, exception, cycle time. Two organizations can run the same standardized flow and produce systematically different outcomes, because the criterion applied at the point of determination was not part of what was standardized. Nor does it reach far into reporting: the path by which an execution fact becomes a number in a management pack lies outside its frame.

2.2. Process modelling quality and comprehension: the artefact that exists but cannot be used

A standardized process that survives only as an unread diagram standardizes nothing. Model understandability is driven jointly by structural properties and reader characteristics, both measurable (Reijers & Mendling, 2011); Figl (2017) synthesized forty empirical studies measuring objective comprehension of process models, seven measuring subjective comprehension and user preferences, and thirty-two articles on influencing factors; and a notation's visual syntax has cognitive consequences evaluable against explicit design principles rather than settled by taste (Moody, 2009).

Practice is less encouraging: modelling initiatives fail for overwhelmingly non-technical reasons of strategy, governance, scope and stakeholders (Rosemann, 2006); the success of a modelling *project* is distinct from the quality of the models it produces (Bandara *et al*., 2005, examining nine modelling projects across three major Australian organizations); and grammar-level ontological deficiencies produce observable problems for practising modellers (Recker *et al*., 2010), consistent with Recker's (2010) account of BPMN use. Comparison across comprehension studies presupposes an explicit measurement instrument for understandability, which had to be constructed (Melcher *et al*., 2010), and reader characteristics condition comprehension as systematically as model properties (Mendling *et al*., 2019). Notational choice is likewise open to evidence: grammars can be compared on representational capability rather than vendor claim (Recker *et al*., 2009), ontological analysis supplies a repeatable method for establishing what a technique can express (Rosemann *et al*., 2009), and the deficiencies it exposes have measurable consequences (Recker *et al*., 2011). What counts as the pressing problem of modelling nonetheless differs between practitioners, vendors and academics (Indulska *et al*., 2009b), as do the benefits organizations attribute to the activity (Indulska *et al*., 2009a).

The existence of a model is therefore not evidence that work is standardized, which is why Section 5 specifies each layer by an artefact *and* by evidence that it is referenced downstream.

2.3. Process improvement traditions: what the evidence does and does not establish

Standardization is usually pursued inside a named improvement method. Such methods give weak systematic guidance for generating redesign alternatives, six key methodological decision areas structuring how redesign concepts are produced (Vanwersch *et al*., 2016); Six Sigma, being manufacturing-derived, meets systematic problems in service processes and requires adaptation (Johannsen *et al*., 2010, synthesizing 131 references); and in smaller firms the binding conditions are organizational, Timans *et al*. (2012) finding for Dutch small and medium-sized manufacturers that "Linking to customer, vision and plan statement, communication and management involvement and participation are the highest ranked CSFs". Lande *et al*. (2016) documented the critical success factors for Lean Six Sigma in small and medium enterprises "in a meaningful manner so that researchers/companies take advantage of Indian experience in prioritizing CSFs for framework"; almost none of the binding conditions is technical, and none concerns outcome consistency.

Reported service-sector effects concern cycle time and its dispersion: Gijo and Antony (2014) reported for an Indian hospital outpatient department that "average waiting time decreased from 57 minutes to 24.5 minutes, while standard deviation fell from 31.15 to 9.27 minutes", and McDermott *et al*. (2022), examining 126 peer-reviewed articles published between 2011 and 2021 selected from an initial database search of over 14,200 publications, found motivations that "include the willingness and, in some cases, the need to comply with national health authority regulations". What none of this establishes is consistency of *outcome* at decision points: the instrumentation measures cycle time, defects and waiting time, so the variability reduced is variability in the flow. A DMAIC project can compress a queue without asking whether two assessors reach the same conclusion on the same file.

2.4. Process performance measurement and process governance

Between the process and reporting literatures sits work on how process performance is measured and who owns the measurement. Process-based organizations require a measurement system built around processes rather than functions, covering non-financial as well as financial dimensions (Kueng, 2000). Van Looy and Shafagatova (2016) consolidated the indicator space, documenting an extended list of 140 process-related performance indicators in eleven performance categories from 76 peer-reviewed publications and identifying supplier performance, societal impact, cost measurement and organizational flexibility as under-covered. The status of an indicator definition has itself been formalized: del-Río-Ortega *et al*. (2019) proposed a graphical notation for defining process performance indicators alongside the process model, over 400 real-world PPIs from various domains being successfully modelled; an indicator specification of the same standing as the process model, which is what the definition layer generalizes. Measurement systems also decay: Bourne *et al*. (2000) concluded from three longitudinal case studies that "specific processes are required to continuously align the performance measurement system with strategy", and alignment of that kind presupposes an owner, which returns the question to governance (Spanyi, 2010).

2.5. Business process compliance: standardization with an external audience

Where a process is regulated, standardization acquires an audience that did not choose it. Sadiq *et al*. (2007) argued that regulatory control objectives can be represented formally and visualized inside process models, observing that "business process design is primarily driven by process improvement objectives. However, the role of control objectives stemming from regulations and standards is becoming increasingly important". Compliance is not only a design-time concern: Ly *et al*. (2015) established a framework of compliance monitoring functionalities for runtime, deriving ten core functionalities across modelling, execution and user requirements. Coverage across the lifecycle is uneven: Hashmi *et al*. (2018), analyzing 79 papers published between 2000 and 2015 selected from an initial pool of 183 studies, reported that compliance management approaches center around three distinct categories, namely design-time (28%), run-time (32%) and auditing (10%), with organizational frameworks at 21% and hybrid approaches at 9%; compliance is accordingly a managed lifecycle capability rather than a periodic audit event (Sadiq & Governatori, 2015). The formal machinery for the design-time half of this has long existed: compliance rules can be expressed as visual queries over process models and checked automatically using temporal logic (Awad *et al*., 2008), so the obstacle to compliance-by-design is not expressive power but the organizational work of stating the rule in checkable form. Where accountability is shared across parties, coordination has been argued to require an explicit governance-alignment mechanism rather than the sum of each party's internal controls (Eyetsemitan *et al*., 2020); a claim from a venue whose review standards this paper does not vouch for.

2.6. Knowledge-intensive and declarative processes: the limits of imperative standardization

A further stream marks the boundary beyond which the object being standardized changes character. Di Ciccio *et al*. (2015) characterized knowledge-intensive processes as "knowledge- and data-centric, and requiring substantial flexibility, at both design- and run-time", which imperative, control-flow-first modelling cannot adequately capture. Pesic *et al*. (2007), observing that "Traditional Workflow Management Systems (WFMSs) are not flexible enough to support loosely-structured processes", showed that a constraint-based approach can support them without sacrificing verification, analysis of past executions and run-time change.

The declarative move is not a weakening of standardization but a change in what is standardized: the constraints any acceptable execution must satisfy rather than the sequence it must follow. Marin *et al*. (2016), evaluating case management definitions spanning 23 years, observed that "Process support for knowledge work is far from being mastered in existing information systems" and that "CMMN seems to be a suitable approach to KiPs when combined with an appropriate execution environment" (Object Management Group, 2016). The stream bounds the framework rather than supporting it, and Section 7.5 develops that boundary explicitly.

2.7. Decision modelling: the separation-of-concerns principle

A distinct stream addresses the omitted object. Practitioner-facing work on decision management argued for treating business logic as a first-class artefact with its own lifecycle rather than as a residue distributed across process models and code (von Halle & Goldberg, 2010; Fish, 2012); a position formalized in the Decision Model and Notation standard (Object Management Group, 2021), complemented by a formalism for the terms, fact types and rules on which such logic depends (Object Management Group, 2019).

The strongest peer-reviewed statement of the principle is Hasić *et al*. (2018), who set out principles for integrated process and decision modelling grounded in the separation of decision logic from process logic. Its empirical motivation comes from Batoulis *et al*. (2015), who observed that real-world process models encode detailed decision logic inside control flow and proposed a semi-automatic method for extracting it. Such burying is thus not an occasional modelling error but a default condition of practice.

Notation is not a neutral instrument, and adopting one is not the same as standardizing: the dominant process standard remains BPMN 2.0.2 (Object Management Group, 2014), complemented for non-sequential knowledge work by CMMN (Object Management Group, 2016), yet Recker (2010) documented practical problems in BPMN use and the recurring claim that it is over-engineered relative to practitioner need, and Mendling *et al*. (2010) found it necessary to codify guidance for models that are comprehensible and less error-prone.

2.8. Data and information quality: dimensions, assessment and governance

The information quality literature begins from the position that quality is fitness for use rather than accuracy alone, organized into intrinsic, contextual, representational and accessibility categories (Wang & Strong, 1996). Later work operationalized assessment (Pipino *et al*., 2002), notably AIMQ (Lee *et al*., 2002), while Nelson *et al*. (2005) decomposed information quality into accuracy, completeness, currency and format. On the infrastructure side, Wixom and Watson (2001), studying 111 organizations, identified the factors affecting the success of centralized reporting, and Popovič *et al*. (2012) added that maturity and analytical culture condition whether better information changes decision behavior.

The dimensions have two independent derivations, which is part of why they have held: Wang and Strong (1996) derived them from what data consumers report needing, while Wand

and Wang (1996) derived a set of them from an ontological account of how an information system represents a real-world system, so that a quality deficiency corresponds to a specific representational mismatch. Strong *et al.* (1997) established that quality is task- and context-dependent, so data adequate for one use may be unfit for another, that is, the definitional layer's central problem once two functions draw on the same records, and Wang (1998) made the field managerially tractable by treating data as a manufactured product with suppliers, production processes and consumers. Assessment is a comparative methodology base rather than a single instrument (Batini *et al*., 2009; Madnick *et al*., 2009), consolidated at book length into dimensions, principles and techniques (Batini & Scannapieco, 2016).

Three refinements bear on a layered framework. Error does not stay where it originates: quality in multi-input, multi-output information processing can be modelled formally, giving an analytical basis for where in a chain of transformations a control belongs (Ballou & Pazer, 1985), and a reporting production path is such a chain. Assessment is better weighted by the business utility of the data than applied uniformly (Even & Shankaranarayanan, 2007), and a metric must satisfy stated formal requirements; a set of five, in Heinrich *et al*.'s (2017) formulation, before it can support an economically grounded decision. The tooling assumed to discharge this work does not yet do so evenly: Ehrlinger and Wöß (2022) identified 667 data quality software tools and evaluated 13 of them, finding profiling covered considerably better than continuous automated monitoring. A definitional standard stated but not monitored is therefore the normal case rather than a lapse, and poor quality carries identifiable costs (Haug *et al*., 2011).

Governance supplies the accountability that assessment presupposes. Khatri and Brown (2010) set out data governance as decision domains including data principles, quality, metadata, access and lifecycle, each with explicit accountabilities; Weber *et al*. (2009), examining six international companies, presented a model of data quality roles, decision areas and responsibilities and argued that no single configuration fits all firms; Otto (2011) documented how large service providers organize those rights; and Abraham *et al*. (2019) consolidated governance mechanisms, scope and domains. Haug and Arlbjørn (2011) supply the sharpest finding: "a lack of delegation of responsibilities for maintaining master data is the single aspect which has the largest impact on master data quality". The activities constituting such governance have been inventoried into an assessment checklist (Alhassan *et al*., 2016), and the object governed distinguished from the technology carrying it (Tallon *et al*., 2013). Vilminko-Heikkinen and Pekkola (2017), in an ethnographic study of a municipality conducted over 32 months, identified 15 organizational challenges in master data management, seven previously unreported, centered on ownership, roles and competing priorities.

2.9. Business intelligence, analytics and decision making

A parallel stream asks whether reporting infrastructure changes what organizations decide. Its measurement scaffold is the information systems success model: DeLone and McLean (1992) proposed the six-dimension taxonomy of system quality, information quality, use, user satisfaction, individual impact and organizational impact; DeLone and McLean (2003) added service quality and collapsed impact into net benefits; and Petter *et al*. (2008) reviewed how each dimension has been operationalized and how the dimensions relate.

Use is contingent. Işık *et al*. (2013) found business intelligence success to depend on fit between capabilities, data quality, integration, flexibility, user access, and the decision environment served, and Chae *et al*. (2014) linked data accuracy rather than analytics sophistication to operational performance. At firm level, Brynjolfsson *et al.* (2011), in a working paper surveying 179 large publicly traded firms, found that firms adopting data-driven decision making have output and productivity 5–6 per cent higher than would be expected given their other investments and information technology usage, an unrefereed cross-sectional estimate. Raghunathan (1999) had shown analytically why the relationship should not be monotonic: the effect of information quality on decision quality is conditional on the decision maker's knowledge of the problem structure, the theoretical companion to the caveat entered by Popovič *et al.* (2012). On presentation, cognitive fit explains why format effects exist (Vessey, 1991), and dashboard research connects design features to decision effects while identifying where evidence remains thin (Yigitbasioglu & Velcu, 2012).

The value pathway has been specified more exactly than the headline claim suggests. Analytics affects performance through changes in decision processes and routines, not through insight generation alone (Sharma *et al*., 2014), so benefit should be measurable first at process level (Elbashir *et al*., 2008); review evidence separates conversion, use and competition as stages at which the pathway breaks (Trieu, 2017). System characteristics have been related to perceived decision quality (Visinescu *et al*., 2017), and decision quality in data-rich settings depends on the whole data supply chain, not analytical capability alone (Janssen *et al*., 2017). Whether such information is used is contingent: disclosing data quality metadata changes decision strategies (Chengalur-Smith *et al*., 1999), but attention to it depends on experience and time pressure (Fisher *et al*., 2003). Adoption of data-driven decision making among United States manufacturing plants rose from 11 per cent to 30 per cent between 2005 and 2010 (Brynjolfsson & McElheran, 2016), diffusion, not an effect estimate. Devolving reporting to its consumers introduces a governance tension rather than resolving one: self-service business intelligence spans degrees from reporting to data preparation (Alpar & Schulz, 2016), and its recurring obstacles are data access, data quality, user skill and governance (Lennerholt *et al*., 2018); the definitional layer arriving as a problem at the visibility layer.

2.10. Performance measurement and the fragility of the production path

Performance measurement adds that measurement is a system to be designed rather than a list of metrics to be selected (Kaplan & Norton, 1992, 1996; Neely *et al*., 1995). On presentation, a formalized notation standard for management reporting exists (Hichert & Faisst, 2022); it is a practitioner standard, not evidence of effect. That presentation is not neutral is nonetheless well supported: review evidence in accounting and reporting contexts shows presentation format systematically changing judgments and decisions (Kelton *et al*., 2010), and the standard practitioner argument is that dashboards fail through poor visual encoding rather than lack of data (Few, 2013). Standardization of the reporting object has been studied where externally imposed: research on machine-readable financial disclosure asks whether standardized reporting reduces information asymmetry (Yoon *et al*., 2011) and what mandating it did to the financial information environment (Kim *et al*., 2012), among the few settings in which such a standard was imposed exogenously and its consequences observed.

The fragility of the production path is documented most directly in work on end-user computing. Panko (1998) established that spreadsheet errors occur in a few per cent of all cells, at rates comparable to those in programming and other cognitive tasks. Panko (2016), a EuSpRIG 2015 paper deposited on arXiv, reports that across 14 laboratory development experiments involving 967 participants working alone the average cell error rate was 3.9 per cent, that field audits of operational spreadsheets report cell error rates of 0.4 to 2.5 per cent, and that collectively the audit studies found errors in 94 per cent of the spreadsheets studied; errors are rare per cell, but in large spreadsheets at least one incorrect bottom-line value is very likely present. Where management reporting is assembled by exactly this means, its fidelity cannot be inferred from its punctuality. What this literature under-treats is the workflow producing the information.

These figures should be handled with the care their own field recommends: Powell *et al*. (2008) reviewed the spreadsheet-error evidence base critically and questioned how the reported rates were obtained, so the claim carried into Section 5 is qualitative: that an unreviewed end-user-computed path is not a control, not a rate for any estate.

2.11. Information systems success, IT value and benefits realization

The last stream explains why an artefact-producing program may change nothing. Melville *et al*. (2004) modelled information technology business value as dependent on complementary organizational resources rather than the technology itself, and a glossary, a decision model and a documented production path are resources of exactly this kind. Ashurst *et al*. (2008) proposed a benefits realization capability model organized around benefits planning, delivery, review and exploitation, and Doherty *et al*. (2012) showed across three case studies that realization depends on practices sustained beyond go-live. The framework's insistence on ownership, versioning and review follows this logic (Ward & Daniel, 2012): an artefact without an owner is not a control, and a control that lapses after delivery is not a control either.

The stream is older than its use in process research acknowledges. Ward *et al*. (1996) established empirically the gap between how information systems investments were appraised and what they delivered; a decade later the same program asked whether practice had improved (Ward *et al*., 2007), and a practice-facing statement of how realization is managed followed (Peppard *et al*., 2007). Later work-related benefits realization management to project success and to strategy execution (Serra & Kunc, 2015), while Badewi (2016) separated project and benefits management practice by success dimension; delivering on time being distinct from delivering benefit. Organizational rather than technical issues are meanwhile under-addressed in systems development projects, and that omission predicts poor outcomes (Doherty & King, 2001). Returns to information technology are in any case mediated, lagged and easily mismeasured (Brynjolfsson, 1993; Kohli & Grover, 2008).

2.12. Codification, practice and the limits of the documented standard

A stream outside these literatures qualifies everything above, and a framework built on artefacts must state it. Organizational knowledge creation has been modelled as conversion between tacit and explicit forms rather than retrieval of an already-explicit stock (Nonaka, 1994), so writing a criterion down transforms the knowledge rather than recording it. Canonical practice diverges from actual practice, learning occurring in communities rather than manuals (Brown & Duguid, 1991), an account developed into a theory of participation and reification (Wenger, 1998). Even demonstrably better practice does not travel easily inside one firm: internal stickiness is driven by absorptive capacity, causal ambiguity and the source–recipient relationship rather than unwillingness (Szulanski, 1996), and knowledge moves through people, tools and tasks, hardest to transfer where embedded in their interaction (Argote & Ingram, 2000). Two consequences follow. A written standard is a claim about practice, so each layer must be evidenced by downstream reference; and where a criterion resists codification, the honest output is documented criteria and evidence requirements rather than a nominal rule.

2.13. The gap

The gap lies between the streams rather than within any of them. Process standardization research standardizes flow but under-treats the decision inside it and the report at the end of it; decision modelling supplies the missing object but remains concerned with notation and integration rather than with organizational standardization and its governance; and information quality and performance measurement research characterizes good information without treating its production as a process to be standardized in the same terms. The subsidiary streams sharpen rather than close that gap: improvement methods reduce variability in flow without instrumenting variability in outcome, compliance research externalizes regulatory logic without joining the result to reporting, and data governance assigns ownership over data domains but not over the decisions that generate the data.

There is a further, organizational reason for the gap. The artefacts that would join the streams such as glossaries, decision tables, metric specifications, must serve operations, reporting analysts, risk functions and external reviewers, each holding a different frame. They are boundary objects in Star and Griesemer's (1989) sense: "plastic enough to adapt to local needs… yet robust enough to maintain a common identity across sites." Where the boundary is semantic or pragmatic rather than syntactic, shared meaning must be translated and, where interests differ, transformed (Carlile, 2004). Star (2010) later corrected the concept's casual use, insisting on the residuality and standardization dynamic most applications drop; the dynamic at issue here, since a glossary is at once a local working aid and an infrastructural standard. The empirical literature is less comforting than the term suggests. Cross-occupational understanding was achieved on one production floor by transforming rather than transmitting meaning (Bechky, 2003b), and shared artefacts encode occupational claims as much as bridge them (Bechky, 2003a). Boundary objects can entrench differences rather than dissolve them (Barrett & Oborn, 2010); cross-boundary work is political (Oborn & Dawson, 2010); and the label is too coarse for the roles objects play (Nicolini *et al*., 2012). The carrying role is structurally specified, boundary spanning being information processing and external representation (Aldrich & Herker, 1977) and, in information systems settings, a competence emerging in practice rather than conferred by appointment (Levina & Vaast, 2005). The framework below is therefore specified in terms of artefacts, ownership and evidence, expecting them to be contested rather than adopted.

3. Standardization Across Applied Domains: Evidence and Instances

3.1. What this section is, and what it is not

This section serves a different purpose from Section 2 and must be read differently. Its function is to show that the problem described here recurs, under other names, wherever an organization must produce consistent decisions and reconcilable numbers.

To do that it draws, deliberately and extensively, on applied and practitioner literature of varying peer-review provenance. That material now constitutes a substantial share of this paper's reference list; a larger share than a conventional review would carry, and a reader is entitled to know what it is and what weight it bears. Many of the contributions cited below appear in venues without an established peer-review record. This paper has not independently assessed their editorial standards, review processes, underlying data, or empirical claims, and does not vouch for any of them. They are cited only for the position their titles and stated purposes assert: that a class of recurring decision, control or report was treated as an object of design, standardization, governance or measurement in a particular applied setting. No statistic, percentage, sample size, effect estimate or numeric finding anywhere in this paper is drawn from any of them. Where the text below describes what a contribution addresses, it describes the object of that work and not any result claimed for it.

The division of labor between this section and Section 2 is accordingly strict. The framework developed in Section 5, the layers and the coupling argument joining them, the assessment rubric, the maturity progression, the degree heuristic, the information-quality mapping and the propositions offered in Section 5.11, together with every quantitative claim made anywhere in this paper, rest on the peer-reviewed literature reviewed in Section 2 and on nothing in this section, and none of them would change if the whole of the material surveyed below were struck out. The section is offered as illustration of the problem's generality across settings, not as an evidential foundation for anything; a reader who discounts the entirety of it will find the argument of Sections 2, 5 and 7 unaffected.

Two cautions attach to composition rather than provenance. The material is weighted toward conceptual frameworks and narrative reviews rather than evaluated interventions, so it documents what practitioners propose, not what they have established; and the domains are not sampled, the clustering below being one of convenience.

3.2. The recurring shape of the applied literature

Read at that level the applied literature has a consistent shape, and the shape is what makes surveying it worthwhile. A decision recurs at volume. An external party such as a regulator, an auditor, a client, a funder, a court, has standing to question both that decision and the numbers describing it. A remedial artefact is then proposed: a framework, a model, an architecture, a dashboard, a maturity ladder, a control catalogue. And the artefact addresses the flow of work, the technology carrying it, or the report emerging at the end of it, while the criterion applied where the outcome is actually determined goes undiscussed and the terms in which the resulting figure is expressed go undefined.

Three regularities recur often enough to name before the domains are taken in turn, each a restatement of the coupling argument in a domain's own vocabulary. The first is that the proposed artefact is characteristically of a *higher* layer than the failure it is meant to repair: where reports disagree, a reporting architecture is offered; where outcomes vary, a workflow or a technology is offered. The remedy is applied where the symptom is visible rather than where the instability originates, which is the sequencing error Section 5.6 describes. The second is that definitional work is presupposed rather than performed: an architecture consolidating reporting across a supply base, a catalogue classifying information assets, a maturity model scoring a capability, each assumes the entities involved are already agreed. The third is that determinacy is nowhere instrumented; whether two qualified people applying the proposed artefact to identical inputs reach the same outcome is, so far as this survey can establish, not asked. That is the diagnostic the decision layer requires, and its absence across so many domains is the most consistent observation the survey supports.

3.3. Financial reporting, audit and internal control workflows

Finance is where definitional instability is least tolerable, because two figures that cannot be reconciled become an audit finding. The peer-reviewed evidence here concerns automating the work, not standardizing the judgement inside it. Cooper *et al*. (2019), interviewing robotic process automation leaders at major professional services firms, reported that "unlike other technology implementations, RPA adoption is driven primarily by lower-level employees". Audit suits rule-based, high-volume evidence work, changing what auditors do rather than only how fast (Moffitt *et al*., 2018), an argument developed into implementation frameworks (Eulerich *et al*., 2022; Huang & Vasarhelyi, 2019) and observed as early practice before any settled control framework existed (Kokina & Blanchette, 2019). Banking supervision, by contrast, has long required something close to the decision layer proposed here, such as independent validation, effective challenge, lifecycle documentation, defining model risk as "the potential for adverse consequences from decisions based on incorrect or misused model outputs and reports" (Board of Governors of the Federal Reserve System & Office of the Comptroller of the Currency, 2011).

The applied literature approaches the same territory from the control side: internal audit quality as improvable through technology-enabled risk assessment (Akomolafe & Agu, 2018); internal controls as designed and prioritized on assessed risk (Akomolafe & Agu, 2019a); financial reporting as a structured model serving accountability (Medon & Oduleye, 2022); statutory reporting frameworks as exhibiting gaps and reform pathways (Dogbatsey & Ebhojie, 2018); a capital allocation judgement as an explicit decision model

(Lawal & Oduleye, 2021a); and a regulated detection obligation as discharged through model-assisted screening (Atakpa & Abetoh, 2022). Each is a decision- or visibility-layer intervention proposed without a definitional predicate.

A wider reading of the same stream extends the pattern. Risk evaluation is proposed as something carried out through explicit models fed by data rather than accumulated institutional judgement (Akomolafe & Agu, 2019b), and governance and compliance activity as integrated strands rather than separately owned functions (Akomolafe & Agu, 2019c); an argument for joining a decision-layer artefact to the reporting obligations consuming its output. Detection obligations attract similar treatment: model-assisted screening is offered as the means by which an anti-money-laundering duty is discharged in banking (Atakpa, 2021), and forensic techniques are applied to transaction records in a regulated service setting (Ekechi *et al*., 2022). Where the object is the control itself, a defined control-testing process is proposed as a candidate for automated execution (Mbonu *et al*., 2022); and where a judgement is exposed to regulatory challenge, an explicit risk model is proposed as the vehicle for making it (Lawal & Oduleye, 2019a).

The mapping back is unusually clean. Each item above intervenes at the decision or visibility layer while presupposing a stable definitional base it does not supply: a control cannot be tested automatically unless what counts as an exception is fixed.

3.4. Financial planning, treasury and forecasting workflows

Adjacent to reporting and audit sits the planning cycle, whose product is a forward-looking figure later compared against an actual. The applied literature proposes formalization of what is otherwise executive habit: a data-driven system is offered as support for strategic financial planning decisions taken at executive level (Lawal & Oduleye, 2019b), consolidation and control across a multi-entity group is structured through an explicit tiered architecture rather than left to periodic assembly (Dada *et al*., 2021a), and a recurring working-capital judgement is supported by a forecasting model built for the purpose (Tonoyan *et al*., 2021b).

The standardization problem here is distinctive. A plan and an actual are two reporting objects that must be built on identical definitions if the variance between them is to mean anything; where they are not, variance analysis measures definitional drift and reports it as performance.

The domain maps to the visibility layer, and specifically to the *reporting object* among its three objects. It also illustrates the constraint stated in Section 5.6: a forecasting model whose inputs are defined by one function and whose outputs are consumed by another delivers reproducibility without comparability.

3.5. Procurement and supplier management decision workflows

Procurement is the canonical high-volume, rules-and-judgement decision workflow, and the domain in which cross-site standardization was first pursued deliberately (Manrodt & Vitasek, 2004). The applied literature treats it as a transactional function open to structured optimization (Okonkwo *et al*., 2018a), as a process into which regulatory obligations are built at design time rather than checked afterwards (Okonkwo *et al*., 2021), and as a place where a recurring operational loss is attributed to process design and removed by redesign (Okonkwo *et al*., 2020). Supplier selection; a decision point in the strict sense, with defined inputs and a bounded outcome set, has been modelled so as to be driven by data rather than unaided judgement (Ahiaeke Patrick *et al*., 2021); automation has been proposed as a route to efficiency and transparency together (Akinleye & Adeyoyin, 2021); and end-to-end visibility across a multi-party chain has been framed as a designed capability (Nnabueze *et al*., 2021). A supplier evaluation is nonetheless reportable only if "supplier", "spend" and "contract" mean one thing across the estate, and unification remains frequently impractical for the reasons Romero *et al*. (2015) identify.

The applied stream is explicit about the distinction between the transaction and the relationship. Contract negotiation and ongoing vendor governance are treated as distinct designable activities rather than phases of one procurement event (Okonkwo *et al*., 2019); the negotiation itself is proposed as a decision open to support by an explicit optimization model (Akinleye & Adeyoyin, 2022a); supplier management is designed backwards from stated strategic objectives (Akinleye & Adeyoyin, 2022b); and the management of external supplier relationships is treated as a designed practice in its own right (Ike *et al*., 2021). The limiting case is the proposal that contractual terms be encoded as executable logic triggering a payment process automatically (Akomolafe *et al*., 2022); the decision layer taken to its end, where the criterion is not merely written down but is the thing that executes.

That proposal is instructive because its preconditions are those the framework states: the terms must be defined once and identically for every party, and the conditions evaluated must be determinate, since an encoded criterion that admits legitimate variation converts drift into policy at machine speed.

3.6. Supply chain, logistics and distribution workflows

Downstream of procurement the same problem presents as one of operational continuity, and the applied literature responds with models and frameworks rather than procedures. Supply chain risk in a project delivery setting is represented as an explicit management model (Agbabiaka *et al*., 2019); operational resilience in a supply process serving critical infrastructure is specified as a framework rather than left implicit (Ogunwole *et al*., 2021); an operational service level is modelled as a function of an upstream inventory process rather than an independently manageable target (Okonkwo *et al*., 2018b); and where the commodity is critical, an early warning signal is linked to a pre-agreed response process rather than to escalation at the discretion of whoever notices (Eze *et al*., 2022a).

Two of these states, in operational language, propositions the framework advances in general terms. Modelling a service level as a function of an upstream process is the coupling argument applied to material flow: the downstream measure is not independently improvable, because its variance is generated upstream. Linking an early warning signal to a pre-agreed response joins the visibility layer to the decision layer, since a signal without a determined response is a report, and a report that changes nothing is the visibility-layer failure mode. A resilience framework, on the framework's reading, is a decision-layer artefact whose determinacy is untested: it states what should be considered, rarely what outcome follows from given inputs.

3.7. Information security, data governance and IT risk controls

Information security has institutionalized control frameworks longer than most domains, and its definitional artefacts like asset inventories, identity records, and classification schemes, are prerequisites rather than aspirations. Access control has been treated as an enterprise-wide design problem once systems span multiple environments (Mbonu *et al*., 2020), access governance at scale as itself a process to be designed and optimized (Mbonu *et al*., 2022b), and reporting architecture as organizable around risk rather than around whatever data happens to be available (Mbonu *et al*., 2021a); a visibility-layer claim with a definitional premise. Audit and risk assessment of information systems have been conducted through defined frameworks rather than ad hoc inspection (Dosunmu & Ogundele, 2019), external intelligence integrated into internal decision processes through explicit frameworks (Dosunmu & Ogundele, 2022), and control architecture positioned within enterprise security governance (Ogbole *et al*., 2021). The theoretical counterpart is in place: governance means decision domains with named accountabilities (Khatri & Brown, 2010) exercised over an information artefact distinct from the technology carrying it (Tallon *et al*., 2013).

The operational half of the domain is where the decision layer becomes visible under another name. A detection-and-response control is implemented as a model whose effectiveness is treated as assessable rather than assumed (Dosunmu & Ogundele, 2020); response to an incident is governed by a pre-specified process rather than improvised under pressure (Dosunmu & Ogundele, 2021); and the steps of detection and response are proposed as automatable on an analytics platform (Mbonu *et al*., 2019), which presupposes that what constitutes an incident has been settled in advance. Identity supplies the definitional base: centralized identity management is described as the mechanism through which enterprise access is administered (Ladapo *et al*., 2019), and an identity record is a definitional artefact in the strict sense of Section 5.2. Where an organization operates across jurisdictions, divergent data protection obligations must be reconciled rather than satisfied severally (Ominyi & Anichukwueze, 2022a); a definitional problem before it is a legal one.

An incident response plan is a decision model written down in advance, with inputs, permitted outcomes and escalation paths, and it is one of the few places in general practice where organizations routinely do decision-layer work. That they do it here is consistent with the paper's argument: where an external audience will interrogate the decision after the fact, the criterion gets externalized.

3.8. Enterprise systems, cloud platforms and delivery pipelines

Enterprise systems are where the workflow and visibility layers meet a package, and where standardization decisions are often made implicitly by configuration. Event-log evidence has been used inside implementation projects to ground the standardization decision in observed rather than stated behavior (Fleig *et al*., 2018); the organizational conditions for using such evidence follow a capability path rather than a tool-installation path (Grisold *et al*., 2021); and expert consensus locates the obstacles to organizational process mining in organizational and data-related rather than algorithmic factors (Martin *et al*., 2021), as the coupling argument would predict. The applied literature approaches operational reporting from the dashboard end: executive visibility gaps as the thing reporting design exists to close (Sanni & Atima, 2021b); dashboards as the mechanism through which delivery is monitored (Orise & Niniola, 2022); model output as surfaced to managers in real time (Filani *et al*., 2022); data-driven operations management as a route to improvement in a non-commercial organization (Efobi *et al*., 2021); and routine management analysis as performed on commodity reporting tools already present in the organization (Akin-Oluyomi *et al*., 2020), which returns the argument to Section 2.10.

Beneath the dashboard sits the platform, treated as an object of governance in its own right. Procurement processes are described as enacted inside enterprise systems and reframed around an additional data source (Ahiaeke Patrick *et al*., 2020), which makes explicit what package-based standardization leaves tacit: the process as executed is the process the configuration permits. Integrating data from multiple systems into one platform is treated as a design problem requiring explicit specification rather than a technical exercise (Badmus *et al*., 2019a); platform management in a regulated setting is governed through an explicit framework (Badmus *et al*., 2019b); review and change control within a delivery team are likewise governed by an explicit framework rather than team convention (Badmus *et al*., 2022a); and configuration expressed as code is proposed as the means by which the deployment process is brought under governance (Mbonu *et al*., 2020b).

The mapping runs to two layers at once. Integration specification and configuration-as-code are definition-layer work under another name, fixing what an entity is and what a permitted state looks like in a form other artefacts must reference. Change control over that configuration is the *Governed* rating of the rubric in Section 5.7, reached independently by a domain that never uses the vocabulary and applied to code rather than to the definitions and decision criteria the framework holds to be logically prior.

3.9. Public sector and regulated reporting obligations

Where the audience for a report did not choose it, the definitional layer becomes non-negotiable and the decision layer accountable in the strict sense. Public-sector automation is constrained by organizational form, legal accountability and administrative discretion in ways private-sector cases do not capture (Lindgren *et al*., 2022), and practitioners deploying algorithmic decision support there meet accountability needs that are procedural rather than statistical (Veale *et al*., 2018). Instances span very different obligations: disclosure regimes determining what an organization must measure and report at all (Ominyi & Anichukwueze, 2022b); complaint records proposed as a data source for predictive compliance monitoring (Adeyelu, 2018); a statutory entitlement discharged through a defined compliance framework applied to service delivery (Oloto & Yeboah, 2022); data quality and interoperability treated as governance and architecture problems prerequisite to analytics at national scale (Ilodigwe & Adesemoye, 2021); and internal audit of an operating practice conducted through a defined system rather than by inspection (Obogo *et al*., 2020a).

The regulated-transaction literature adds a variant in which the external audience does not merely receive a report but controls whether the organization may act at all. An external approval process is described as imposing a defined sequence of evidence and decision steps on the organization seeking it (Ominyi & Anichukwueze, 2020), and compliance regimes as differing across markets and imposing correspondingly different operational obligations on the same firm (Ominyi & Anichukwueze, 2021). The translation problem this creates is stated directly: externally stated tax and regulatory requirements are proposed as systematically translatable into executable organizational workflows (Eyetsemitan *et al*., 2021); the layered move of this paper is carried out in one domain without the layers being named. Readiness for such obligations is itself expressed as a staged maturity model (Eze *et al*., 2022b), and where obligations conflict, reconciliation is proposed inside an explicit decision framework rather than left to case-by-case argument (Okojie & Abioye, 2020).

Translating an external requirement into an executable workflow is definition-layer and decision-layer work performed in sequence: the requirement supplies terms that must be defined once, and the obligation supplies criteria that must be externalized if the organization is ever to show it applied them consistently.

3.10. Operational technology and critical infrastructure controls

Control of physical operations under regulatory supervision offers a domain where criterion, flow and report are tightly coupled by the nature of the plant. A named regulatory standard is described as driving specific architectural and control requirements rather than general assurance activity (Adegbite *et al*., 2020); the convergence of previously separate information and operational technology estates is described as requiring explicit governance alignment (Adegbite *et al*., 2022); and the adoption of a new control architecture is framed as an implementation problem, not only a design one (Ahmed *et al*., 2021). Where prediction triggers operational action, interpretability is treated as a requirement of the model rather than a desirable extra (Komi & Adamolekun, 2021).

Each maps to a layer without much strain. A regulatory standard driving specific architectural requirements is a definitional artefact imposed from outside: it fixes what an asset is and which assets are in scope, and every control above it inherits those definitions. Governance alignment across converging estates is definitional reconciliation between two vocabularies that named the same objects differently for years, and the insistence that alignment rather than technology is the hard part restates the coupling argument. The interpretability requirement bears on the decision layer: Section 5.3 argues that where logic must be legible to a reviewer an interpretable rule is a stronger control than a post hoc explanation of an opaque one, and this literature arrives at the same position from the direction of consequence.

3.11. Analytics and predictive decision systems in operational settings

A large applied stream proposes predictive models as support for recurring operational and commercial decisions, and it is the stream in which the gap between predicting and deciding is widest. Human-in-the-loop configurations are described as an established design pattern for machine learning systems (Ladapo *et al*., 2022); predictive models are applied to a routine commercial targeting decision inside a regulated service business (Atima *et al*., 2022); commercial planning frameworks are built to accommodate compliance constraints explicitly (Sanni & Atima, 2021a); automation driven by artificial intelligence under compliance constraints is argued to need an explicit control layer of its own (Sanni *et al*., 2022); and process optimization is modelled algorithmically with its financial consequences assessed alongside (Tonoyan *et al*., 2022b).

The pattern is that the model is proposed as the artefact while the decision procedure around it is left implicit. A human-in-the-loop design specifies that a person is present at the decision point; it does not specify the criterion by which that person overrides, accepts or escalates, and it is the criterion rather than the presence that determines whether two operators handle the same case alike. The proposal that an automated process under compliance constraint needs an explicit control layer is the closest this literature comes to naming the decision layer, and it arises where an external compliance audience exists; consistent with Section 3.7.

The mapping is to the decision layer and its diagnostic property: Section 5.3 holds that an accurate model does not by itself yield a consistent operational decision, whereas this domain's literature is organized almost entirely around accuracy.

3.12. Process improvement and quality management in smaller organizations

The peer-reviewed improvement-method literature reviewed in Section 2.3 already establishes that the binding conditions in smaller firms are organizational rather than technical (Lande *et al*., 2016; Timans *et al*., 2012). The applied literature extends that observation: standard improvement methodologies require simplification before they can be applied at all in resource-constrained organizations (Ambali *et al*., 2021), a defined process-redesign method can nonetheless be applied to shorten cycle time in an administrative workflow in a small professional firm (Oyeleye *et al*., 2022), and standard operating procedures function as deliberate management instruments rather than compliance overhead in small business operations (Eyetsemitan *et al*., 2022). Adjacent work on small operators in a different sector makes the parallel point that the constraints binding technology adoption can be socioeconomic rather than technical (Michael & Ogunsola, 2022a).

The relevance to the framework is twofold. The interventions reported are workflow-layer interventions measured by workflow-layer outcomes: cycle time, waste, the sequence of steps. Section 2.3 notes that dispersion in duration and dispersion in outcome are different quantities, and a redesign shortening an onboarding sequence says nothing about whether two staff would classify the same client identically. More usefully, the position that a method must be simplified before a small organization can carry it supports the contention that the *unit* of standardization should narrow rather than the ambition be abandoned; the move the degree heuristic in Section 5.9 makes.

3.13. Program and project governance

Program settings pose the standardization problem across organizational boundaries rather than within one, and the applied literature responds with delivery models and governance frameworks. Distinct delivery models for capital programs are described as selectable according to risk profile (Aminu-Ibrahim *et al*., 2019); delivery in a highly regulated environment is organized around an explicit risk management approach rather than around schedule alone (Ogbete *et al*., 2021); resource planning across a multi-stakeholder portfolio is supported by forecasting models rather than by negotiation between managers (Edivri & Oteri, 2022); and coordination where several parties share accountability is argued to require an explicit governance-alignment mechanism rather than the sum of each party's internal controls (Eyetsemitan *et al*., 2020).

The last of these states the domain's central difficulty. A program reports upward on a schedule and a cost base assembled from parties who define neither identically, and no reporting discipline at the center repairs a definitional divergence at the periphery. This is the definition-layer constraint on the visibility layer, met where the parties have no shared systems and often no shared incentives, and it is why the framework specifies ownership and version as properties of a definitional artefact rather than treating publication as sufficient. Selecting a delivery model by risk profile is meanwhile a contingency argument of the same shape as the degree heuristic in Section 5.9.

3.14. Health, safety and risk management systems

Safety management has the longest institutional history of treating a management system, rather than an instruction, as the unit of intervention, and its applied literature is correspondingly framework-heavy. Routinely captured observation data is described as used, or under-used, as an input to management decisions (Arumosoye & Obriki, 2019); capability in the practice area is expressed as a staged maturity model grounded in learning (Arumosoye & Obriki, 2021); a reporting system is described as the mechanism by which weak signals reach organizational attention (Obogo *et al*., 2021); a control activity is placed on a data-driven footing and modelled as such (Obriki & Arumosoye, 2018); and internal audit of an operating practice is conducted through a defined system rather than by inspection (Obogo *et al*., 2020a).

This domain is the survey's cleanest illustration of the visibility layer serving a decision rather than an audience. A near-miss report is a reporting object in the framework's sense: purpose, recipient, production path, a definition of what it counts, and its value lies wholly in whether it changes a subsequent decision. The literature's own observation that such data is under-used is, in the framework's terms, the visibility-layer failure mode: information that is punctual, voluminous and inconsequential. The definitional dependency is equally visible, since two sites applying different thresholds for what counts as a near miss will produce incomparable safety reporting while each remains internally consistent.

3.15. What the survey establishes, and what it does not

The survey establishes that the problem is recognized across domains that do not read one another's literatures, and that the remedies proposed in each are artefact-centered in the way the framework anticipates. Across every domain above, the three regularities identified in Section 3.2 hold: the remedy is applied a layer above the instability, definitional agreement is presupposed rather than produced, and outcome consistency at the point of determination is not measured.

It does not establish that the framework works, that the layers are correctly ordered, or that any intervention described improved any outcome. It cannot: the material is largely conceptual, it was not systematically sampled, and generality of a *problem* is not generality of a *solution*. The most that can be claimed is a convergence observation that practitioners in unrelated domains, facing the same accountability structure, independently propose artefacts of the kinds the framework specifies and independently omit the layer it identifies as most often skipped.

The composition of the material is itself a caution extending beyond the venues used here: even in the peer-reviewed automation literature, systematic mapping has found much available material to be industrial rather than scientific (Enríquez *et al*., 2020), and public discourse carries a hype trajectory distinct from its evidence base (Kregel *et al*., 2021). The appropriate response is neither to discard applied literature nor to treat it as evidence, but to be explicit about which role it plays; Section 8 restates that position among the paper's limitations.

4. Method

This paper is a conceptual contribution. The framework was developed by structured narrative synthesis of the literature identified in Section 2, read against the author's professional experience of business analysis practice. No primary data were collected, and the framework has not been empirically validated. Section 8 sets out the limitations, and Section 7.2 proposes a validation agenda.

The synthesis identified, within each stream, the object it takes to be the thing standardized and the object it leaves implicit, and then ordered the resulting constructs into layers by dependency, placing a layer below another where the second cannot be made stable without the first.

The instruments in Section 5 were derived rather than observed. The rubric levels follow the common progression from absent to locally held to organizationally defined to governed, and the maturity progression takes its form from the business process management maturity tradition (de Bruin & Rosemann, 2005), the capability view of process management (Rosemann & vom Brocke, 2014), the process audit conception of enterprise-level enablers (Hammer, 2007), and the broader capability-maturity logic on which such models are built. The propositions are proposals for evaluation, not findings.

5. The RDWS Framework

5.1. Overview

The framework treats decision workflows and reporting workflows as one standardization object in four layers, each defined by what it standardizes, the artefact evidencing that standardization, and the failure mode appearing when it is neglected while adjacent layers are addressed. The layers are ordered by dependency, from definition at the base to visibility at the top (Table 1).

Table 1: The four layers of the RDWS framework.

Layer	Standardization object	Key artefact	Characteristic failure mode	Supporting literature
L1 Definition	Shared vocabulary: what a case is, what "completed" means, what a metric counts, which events are in scope	Controlled business glossary and metric specification register, with owners and versions	Two reports that are both correct and irreconcilable	Wang and Strong (1996); Object Management Group (2019); Berry and Kamsties (2004); Pipino *et al.* (2002)
L2 Decision	Decision points named; logic externalized from control flow; criteria, thresholds and escalation made explicit	Decision model with input data, logic and outcome set, held separately from the process model	Variation that looks like judgement but is actually drift	Object Management Group (2021); Hasić *et al.* (2018); Batoulis *et al.* (2015); von Halle and Goldberg (2010); Fish (2012)
L3 Workflow	Activity sequence, roles, handovers, exception routes, variant set, and the chosen degree of standardization	Process model at a declared grain, with a variant register and exception taxonomy	Standardizing the wrong grain: conformance without effect	Münstermann *et al.* (2010); Muenstermann *et al.* (2010); Wüllenweber *et al.* (2008); Schäfermeyer *et al.* (2012); Romero *et al.* (2015); Object Management Group (2014, 2016); Recker (2010); Mendling *et al.* (2010)
L4 Visibility	The reporting object, its production path from source to published artefact, and its presentation convention	Report register, documented production path with reconciliation checks, and a presentation standard	Management visibility that is high-frequency and low-fidelity	Wixom and Watson (2001); Nelson *et al.* (2005); Lee *et al.* (2002); Popovič *et al.* (2012); Kaplan and Norton (1992, 1996); Neely *et al.* (1995); Hichert and Faisst (2022); Panko (1998, 2016)

5.2. Layer 1 Definition

The definition layer standardizes meaning: what constitutes a case, when it begins, what "completed" means, which events fall inside a metric, and what unit is counted when a number is reported.

The anchor is the fitness-for-use conception of quality (Wang & Strong, 1996): quality is a relation between the data and the use a consumer makes of it, so two figures can each be accurate with respect to their own definitions and jointly useless to a manager who must reconcile them. The formal instrument is a business vocabulary standard (Object Management Group, 2019), which supplies not the vocabulary but the discipline of writing one in a form that can be checked for completeness and contradiction.

The layer's failure is silent. Definitional divergence surfaces only when two artefacts are placed side by side, an instance of the observation that ambiguity is typically undetected rather than merely present, because each reader resolves it plausibly and privately (Berry & Kamsties, 2004). A definitional artefact must therefore be evidenced: a glossary that no downstream artefact references is not a control.

Two commitments underpin the layer. The first is that quality dimensions are not an arbitrary list: Wand and Wang (1996) derived them from the correspondence between an information system and the real-world system it represents, so a definitional failure is a specific representational defect: an ambiguous mapping between a real-world state and its recorded state, and is not repairable downstream. The second is that fitness is relative to a task (Strong *et al.*, 1997), so the layer establishes not one true definition but one *published* definition per unit of count, with the uses it is fit for stated.

Governance separates the *Standardized* from the *Governed* rating in the rubric below: decision domains with named accountabilities (Khatri & Brown, 2010), mechanisms consolidated by Abraham *et al.* (2019), and a configuration contingent on firm context (Weber *et al.*, 2009). The warrant for insisting on it is Haug and Arlbjørn's (2011) finding that undelegated responsibility has the largest single impact on master data quality. Precision at this layer does not require formalism: constrained natural-language templates reduce ambiguity in written specifications without recourse to formal notation (Mavin *et al.*, 2009), and that is the register for a metric specification.

5.3. Layer 2 Decision

The decision layer standardizes the point at which an outcome is selected from alternatives on the basis of inputs. Its objects are the inventory of decision points, the externalization of the logic applied at each, and explicit criteria, thresholds, evidence requirements and escalation paths.

The governing principle is separation of concerns: decision logic should be modelled as a first-class artefact and integrated with, rather than embedded in, the process model (Hasić *et al.*, 2018), for which DMN is the notational instrument (Object Management Group, 2021). The principle needs stating because practice runs the other way (Batoulis *et al.*, 2015): logic living inside a sequence of gateways is not reviewable by the people who own it, not testable independently, and not changeable without touching the flow.

The diagnostic property of this layer is determinacy: the degree to which a decision point produces the same outcome from the same inputs. It is a property of the decision as enacted, not of the document describing it, and it partitions variation into two kinds that look identical in aggregate reporting. High determinacy indicates a decision that is effectively rule-governed, whether or not the rule has been written down; low determinacy indicates either genuine judgement; irreducible, legitimate, properly owned by a qualified human, or undocumented variation, which is drift wearing the costume of expertise. Only measurement separates the two, and in its absence, it is argued here, organizations tend to classify drift as judgement. The failure mode follows: variation that looks like judgement but is actually drift, so that outcome consistency does not improve when flow is standardized, because the flow was never where the outcome was determined.

Two further bodies of work ground the layer. The compliance-by-design tradition arrived independently at the same structural move, representing regulatory control objectives formally within process models rather than leaving them implicit in procedure (Sadiq *et al.*, 2007), extending this to runtime monitoring (Ly *et al*., 2015), and treating compliance as a managed lifecycle capability (Sadiq & Governatori, 2015) whose coverage is measurably uneven (Hashmi *et al*., 2018). Two literatures with different motivations thus reach the same conclusion, and the decision layer treats regulatory rules and business criteria as one class of object for that reason. The second is the distinction between predicting and deciding (Bertsimas & Kallus, 2020): an accurate model does not by itself yield a better operational decision. That is why the layer's diagnostic property is determinacy rather than accuracy, and why improving the information alone should not be expected to improve the outcome, that effect being conditional on the decision maker's knowledge of the problem structure (Raghunathan, 1999).

A third body of work bears on the layer's commonest substitute: leaving the logic implicit and relying on human oversight. Banking supervision institutionalizes the alternative, requiring independent validation and effective challenge of the logic behind consequential decisions (Board of Governors of the Federal Reserve System & Office of the Comptroller of the Currency, 2011). Oversight alone is a weak control: automating the tractable part of a task leaves the human the residual hard part while eroding the skill to perform it (Bainbridge, 1983); automation bias produces errors of omission and commission (Skitka *et al*., 1999); the design objective is reliance calibrated to capability rather than maximal trust (Lee & See, 2004); and reliance is unstable in a way that matters for escalation design, people abandoning a statistically superior rule faster than an equally erring human after one observed error (Dietvorst *et al*., 2015). Where logic must be legible to a reviewer, an interpretable rule is a stronger control than a post hoc explanation of an opaque one (Rudin, 2019).

5.4. Layer 3 Workflow

The workflow layer is process standardization proper: sequence, roles, handovers, exception routes, and the deliberate choice of how far to unify. It has the strongest empirical support (Münstermann *et al*., 2010), the associated case reporting a reduction in time-to-hire from 92 to 69 days and approximately 30 per cent in overall process cost, with improved data quality and transparency (Muenstermann *et al*., 2010). Wüllenweber *et al*. (2008) showed, across 335 outsourcing ventures in 215 German banks, that standardization improves outsourcing success both directly and through better monitoring and governance; itself an argument for the coupling developed in Section 5.6, since monitoring is a Layer 4 capability enabled by Layer 3 conditions.

The boundaries are equally well evidenced: higher effort cannot compensate for higher process complexity (Schäfermeyer *et al*., 2012), and full unification is frequently impractical (Romero *et al*., 2015). The framework therefore treats *degree of standardization* as an explicit design decision, evidenced by a variant register in which each surviving variant carries a stated justification.

Notation belongs here as instrumentation rather than substance: BPMN remains the process modelling standard (Object Management Group, 2014), CMMN addresses non-sequential knowledge work (Object Management Group, 2016), Recker (2010) documented persistent difficulties in BPMN use, and Mendling *et al*. (2010) codified guidance for models people can read. The characteristic failure mode is standardizing at the wrong grain: models detailed enough to be expensive to maintain and abstract enough to omit the determining criteria.

The grain problem has an empirical literature behind it: understandability is jointly determined by a model's structural properties and its readers' characteristics (Reijers & Mendling, 2011), the accumulated comprehension evidence is substantial enough to be treated as a design constraint (Figl, 2017), and the notation's visual syntax is open to principled evaluation (Moody, 2009). A declared grain is therefore part of the standard: a model the complying roles cannot read is not a lighter control but no control. What improvement method demonstrably delivers here is reduction in cycle time and in its dispersion (Gijo & Antony, 2014; Vanwersch *et al*., 2016), a Layer 3 achievement that is not evidence about Layer 2, since dispersion in duration and dispersion in outcome are different quantities. The layer's conformance claim can likewise be made precise, deviation between a prescribed model and observed behavior being formally measurable with fitness and precision as distinct properties (Carmona *et al*., 2018), a distinction formalized early in the field, between a model permissive enough to accept everything and one precise enough to accept almost nothing (Rozinat & van der Aalst, 2008); this is what makes the coupling argument in Section 5.6 testable rather than rhetorical.

5.5. Layer 4 Visibility

The visibility layer standardizes management reporting as a workflow rather than an output. It has three objects: the *reporting object* (what a report is for, who receives it, what it counts, at what frequency), the *production path* (the reconstructible route from source records to published figure), and the *presentation convention* (notation, layout and labelling).

The warrant for treating consolidated reporting infrastructure as an organizational rather than technical achievement is Wixom and Watson (2001), whose study of 111 organizations identified the factors affecting success. Nelson *et al*. (2005) supply the decomposition into accuracy, completeness, currency and format that gives the layer measurable properties, and Lee *et al*. (2002) an assessment methodology. Popovič *et al*. (2012) qualify the enterprise: a technically excellent Layer 4 may still alter nothing, since maturity and analytical culture condition whether better information changes behavior.

Measurement design belongs here too: financial measures alone "can give misleading signals for continuous improvement and innovation" (Kaplan & Norton, 1992), measurement being an instrument of strategy (Kaplan & Norton, 1996) and a system design problem (Neely *et al*., 1995). A report, on this view, is not a set of metrics but a system with an input, a transformation and an intended use. Presentation is standardizable independently of content (Hichert & Faisst, 2022), that standard being practitioner guidance rather than evidence of effect.

The production path is where the layer most often fails. Given the error rates reported for end-user spreadsheet development and audit (Panko, 1998, 2016), an unreviewed end-user-computed path should not be treated as a control; the implication is not that spreadsheets be abolished but that reconciliation and independent review are required. The failure mode is accordingly management visibility that is high-frequency and low-fidelity: a pack that arrives reliably and reports numbers whose derivation cannot be reconstructed.

The layer's success criteria are borrowed rather than invented: system quality, information quality and use are distinguished from impact (DeLone & McLean, 1992), impact is consolidated into net benefits with service quality added (DeLone & McLean, 2003), and each dimension's operationalization is documented (Petter *et al.*, 2008). A reporting object can therefore score well on system and information quality and deliver no net benefit, because benefit accrues through use, which is conditioned by the decision environment served (Işık *et al*., 2013) and by data quality rather than technology (Chae *et al*., 2014). Measurement design is likewise a process rather than a selection (Bourne *et al*., 2000; Kueng, 2000), so each reporting object carries a review cycle as well as a definition and a production path, the visibility-layer analogue of the variant register. Reconciliation is the layer's only genuine control: given the reported error rates (Panko, 1998, 2016) and the methodological caution appropriate to them (Powell *et al*., 2008), any published figure must be reconstructible and reconciled by someone other than its author. Reconstructibility is a traceability problem in the technical sense, whose harder half lies upstream, in rationale and provenance lost before the specification is written rather than in the links recorded after it (Gotel & Finkelstein, 1994). A control at the end of a path cannot repair the path, which is why such weaknesses have been argued to require redesign of the underlying financial workflow (Dogbatsey *et al*., 2019), from a venue this paper has not independently assessed.

5.6. The coupling argument

The four layers are not a checklist: each constrains the layers above it, and the framework's substantive claim concerns those constraints.

Layer 4 cannot be standardized without Layer 1. A report is an assertion about entities and states. If "case" and "completed" are not fixed, standardizing the production path merely standardizes the transport of an ambiguity: reproducibility without comparability. This is why reporting programs that begin at the pipeline so often terminate in reconciliation work.

Layer 4 cannot be trusted without Layer 3. Reporting draws on execution records, a by-product of how work is performed; where the workflow is not standardized, the meaning of an event record varies with local practice and the report inherits that variance undetectably. That standardization improves outsourcing success partly *through* improved monitoring and governance (Wüllenweber *et al*., 2008) is consistent with this direction of constraint.

Layer 3 does not produce outcome consistency without Layer 2. This is the least intuitive coupling and the most consequential. Standardizing flow makes the *route* through a process uniform; it does not make the *outcome* uniform, because the outcome is determined at decision points whose logic may remain embedded in individual practice. An organization can therefore achieve high conformance alongside continued outcome variance and, because conformance is what it measures, believe standardization achieved.

Layer 2 is the layer organizations most often skip. It is the least visible, the most politically sensitive, and the least well served by conventional tooling: the decision is buried inside control flow by default (Batoulis *et al*., 2015), and extracting it exposes expert practice as more variable than the organization prefers to believe. Skipping it is affordable in the short run because nothing in Layers 3 or 4 immediately breaks.

It becomes unaffordable later, and the form the cost takes can be named. What opens where Layer 2 is skipped is a specification gap: the distance between the way a business states a desired outcome and the level of precision an automated system requires to produce it. The gap is not a failure of translation to be closed by a more skilled analyst at the end of the sequence; it is the accumulated residue of the definitional and decision work not done beneath. The position taken here is that a decision point is a viable candidate for specification, and afterwards for automation, only where its logic is explicit and its determinacy established: where logic is implicit there is nothing to specify but the observed behavior of a population of assessors, and where determinacy is low and its source unknown, any rule written down encodes drift as if it were policy. This is consistent with automation selection criteria, in which frequency and determinism function as selection properties (Dumas *et al*., 2022), with the differing preconditions of rule-based and model-based approaches (Ng *et al*., 2021), and with the observation that upstream neglect of definitional and data work compounds downstream (Sambasivan *et al*., 2021). These preconditions are developed further in the author's ongoing work on automation readiness.

The practical form of the argument is a sequencing rule: where the layers are addressed out of order, visibility first, because it is the layer management can see effort at the upper layers is bounded by the weakest layer beneath. It is argued here that this, rather than any deficiency of tooling, accounts for a large share of the disappointment organizations report from reporting and automation programs alike. A frequently cited industry observation places early robotic process automation project failure at thirty to fifty per cent (EY, 2016); it should be read as practitioner experience rather than as a measured rate, and the academic literature has recirculated it without independent verification. It does not establish the coupling claim.

5.7. Assessment rubric

Table 2 converts the layers into an assessment instrument: three criteria per layer, rated Absent, Local (held within a team or individual practice), Standardized (defined once for the estate in scope and published), or Governed (named owner, version control, change process, periodic review). It produces a profile rather than a score, because the coupling argument implies that a low rating at a lower layer is not compensable by a high rating above it.

Table 2: RDWS assessment rubric.

Layer	Criterion	Absent	Local	Standardized	Governed
L1	1.1 Entity and state definition	"Case" and its states used differently across units; nothing written	Written definitions within individual teams, unreconciled	One published definition of the case entity, its lifecycle states and the unit of count	Named owner, versioning, and impact assessment on dependent artefacts before change
L1	1.2 Metric specification	Metrics named; numerator, denominator, filters and time basis unspecified	Specifications held inside the reporting team's working files	Every published metric has a written specification with inclusion and exclusion rules and time basis	Specifications versioned and dated, with rules for restating history when a definition changes
L1	1.3 Vocabulary coverage and formalism	No controlled vocabulary	Departmental glossaries with conflicting terms	Enterprise glossary structured after a business vocabulary formalism, covering terms, fact types and constraints	Glossary is the referenced source for process, decision and reporting artefacts, and is audited for coverage and contradiction
L2	2.1 Decision point identification	Decisions implicit within task descriptions	Some decisions named in local procedures	Every decision point in scope named, with inputs and permitted outcome set	Maintained decision inventory with assigned owners and a review cycle
L2	2.2 Externalization of logic	Logic resides in control flow or individual expertise	Logic written as prose guidance of variable precision	Logic expressed in a decision model held separately from the process model, checked for completeness and overlap	Decision models versioned, tested against sample cases, changed only through rule-owner approval
L2	2.3 Determinacy assessment	Outcome variation neither measured nor discussed	Assessor variation acknowledged anecdotally	Determinacy assessed periodically per decision point; for example by independent re-assessment of identical inputs, and recorded	Determinacy expectations set per decision point; deviations trigger rule revision or explicit reclassification as judgement
L3	3.1 Model existence and grain	No process model	Team-level models at inconsistent granularity	One model per process family at a declared granularity, following stated modelling guidance	Models under configuration control, aligned to a declared standardization degree, reviewed on change
L3	3.2 Variant management	Variants unknown	Variants known informally to those who operate them	Variants enumerated, each with a stated justification such as legal, channel or product	Variant register with approval required for new variants and periodic pruning
L3	3.3 Exception and handover handling	Exceptions handled ad hoc; handovers undefined	Team-specific workarounds	Exception types defined with routing rules, ownership and expected handling	Exception volumes monitored and fed back into decision and process revision
L4	4.1 Reporting object definition	Reports proliferate with no register	Team-level report inventories	Register of reporting objects stating purpose, audience, definitions used and frequency	Register owned, with retirement policy and change control tied to Layer 1 definitions
L4	4.2 Production path	Figures assembled manually from ad hoc extracts	Individual, undocumented end-user spreadsheets	Documented, repeatable path from a defined source to the published artefact	Path controlled with reconciliation checks, independent review, and an audit trail sufficient to reconstruct a published figure
L4	4.3 Presentation convention	Labels, units and chart forms vary within a single pack	Convention varies by author	Organization-wide notation and layout convention applied to published reporting	Convention maintained as an artefact and its comprehension periodically reviewed with recipients

5.8. Maturity progression

Table 3 states a five-level progression for the combined reporting-and-decision estate, each level with an entry condition and observable evidence, in the form of the maturity tradition described in Section 4 (de Bruin & Rosemann, 2005; Hammer, 2007; Rosemann & vom Brocke, 2014).

Table 3: Maturity progression for the reporting-and-decision estate.

Level	Name	Entry condition	Observable evidence
1	Opaque	None	Definitions differ across units; reports cannot be reconciled; decision criteria exist only in individual practice; reporting produced from individually held files
2	Locally consistent	Units have written procedures for their own work	Team glossaries and procedures; per-team reports internally consistent but not comparable; variation between teams visible but unexplained
3	Defined	Enterprise definitions and process models published for the estate in scope	Single case and metric definitions; one process model per family; decision points named with inputs and outcomes; a register of reporting objects
4	Governed	Decision logic externalized and determinacy assessed; ownership assigned across all four layers	Decision models under version control and tested; variant and exception registers maintained; reporting production path documented with reconciliation checks; definitional change triggers impact assessment
5	Evidence-led	Execution and outcome data instrumented and routinely analyzed against the standard	Determinacy tracked over time per decision point; outcome variance analysis drives rule revision; the chosen degree of standardization is stated, justified and revisited; candidates for further specification or automation identified from evidence rather than intuition

Two qualifications attach. Progression is not uniformly desirable: full unification is often impractical for cultural, legal or operational reasons (Romero *et al*., 2015), so a legitimately heterogeneous estate may be correctly positioned at Level 3 for its workflow layer while reaching Level 4 for definition and reporting. And higher effort does not defeat complexity (Schäfermeyer *et al*., 2012). The ladder describes the state of the standardization system; it does not prescribe a target for every process.

5.9. A standardization-degree heuristic

Because the appropriate degree is contingent, Table 4 reads four situational factors including complexity, regulatory exposure, volume, and the legitimacy of local variation, and returns a defensible degree with a primary target layer. The heuristic is argued rather than derived from data; its contingency logic follows Romero *et al*. (2015) and Schäfermeyer *et al*. (2012), and its treatment of regulatory exposure follows from the observation that accountability requires an identifiable actor, forum, relationship, content and consequence (Wieringa, 2020); none of which survives an undocumented decision.

Table 4: Standardization-degree heuristic.

Profile	Complexity	Regulatory exposure	Volume	Legitimacy of local variation	Defensible degree and primary target
A	Low	High	High	Low	Full unification of L1–L3; governed L4. Strongest candidate for subsequent specification and automation work
B	Low	Low	High	Low	Unify L1–L3; allow presentation convention to vary by audience. Efficiency is the dominant benefit
C	High	High	Moderate	Low	Unify L1 and L2 fully; standardize L3 only at coarse grain; states, interfaces, handovers, leaving intra-stage method local
D	High	High	Low	High	Standardize L1 and L4 fully; at L2 document criteria and evidence requirements as structured judgement rather than executable rules
E	Low	Low	Low	High	Standardize L1 only; leave workflow local. Standardizing further costs more than it returns
F	High	Low	High	Moderate	Standardize L1 and outcome definitions; decompose the process and standardize only those sub-decisions that assessment shows to be determinate

The heuristic's central move is that the *unit* of standardization narrows as complexity and legitimate variation rise: where a whole process cannot defensibly be unified, its definitional base and its determinate sub-decisions usually still can be, preserving the reporting layer even where the workflow layer must remain plural.

5.10. Which information-quality properties each layer governs

The layers can also be read as a division of labor over information quality, which clarifies why none substitutes for another. Table 5 sets out that reading using the canonical quality categories (Wang & Strong, 1996), the data warehousing decomposition (Nelson *et al*., 2005), and the data governance decision domains (Khatri & Brown, 2010). The mapping is analytical rather than empirical, and the categories were developed for data artefacts rather than processes, so their application to Layers 2 and 3 is an extension by argument.

Table 5: Information-quality properties governed by each layer.

Layer	Quality category primarily governed (Wang & Strong, 1996)	Attribute most directly affected (Nelson *et al*., 2005)	Governance decision domain most engaged (Khatri & Brown, 2010)	Observable evidence the layer is operative
L1 Definition	Contextual and representational: what the figure is about, and whether it means the same thing to two readers	Completeness and format, since neither is assessable against an unstated scope or unit	Data principles and metadata	Process, decision and reporting artefacts cite glossary entries and metric specifications by identifier and version
L2 Decision	Intrinsic: whether the recorded outcome is a property of the case or of the assessor who handled it	Accuracy of the outcome record	Data quality: the rules by which values are produced	Decision models held separately from process models, tested against sample cases, with determinacy assessed and recorded per decision point
L3 Workflow	Contextual: the timeliness and coverage of the execution record from which reporting is drawn	Currency and completeness of event records	Data lifecycle	A model at a declared grain, a variant register with stated justifications, an exception taxonomy, and measurable conformance
L4 Visibility	Accessibility and representational: whether the figure reaches its audience in a form that can be used and interrogated	Format, and the reconstructibility of any accuracy claim made for the figure	Data access	Report register, documented and reconciled production path, applied presentation convention

The mapping's purpose is diagnostic: an organization investing only at Layer 4 governs accessibility and representation while leaving intrinsic and contextual quality ungoverned.

5.11. Propositions

The following are proposals for empirical evaluation, not findings; no evidence is presented for any of them.

P1. Organizations whose definitional artefacts (L1) are governed rather than merely standardized exhibit fewer reconciliation disputes between reports drawn from different functions, controlling for reporting volume.

P2. Workflow standardization (L3) improves process-conformance measures irrespective of decision standardization (L2), but improves outcome-consistency measures only where L2 has been addressed.

P3. The relationship between decision-layer standardization and outcome consistency is mediated by measured determinacy at the affected decision points.

P4. Measured determinacy at a decision point predicts the rework and exception rate of any subsequent specification or automation built on that decision point more strongly than does the volume of the decision.

P5. Reporting produced through an uncontrolled end-user-computing path exhibits a higher incidence of undetected defects in published figures than reporting produced through a documented and reconciled production path, consistent with the error rates reported for end-user spreadsheet development (Panko, 2016).

P6. The performance return to increasing standardization degree is contingent on process complexity, such that beyond a complexity threshold additional standardization effort yields no further outcome improvement (following Schäfermeyer *et al*., 2012).

P7. Estates in which Layer 2 is absent while Layers 3 and 4 are standardized exhibit higher rates of abandonment or scope reduction in subsequent automation initiatives than estates in which all three layers are addressed.

P8. Maturity progression is non-monotonic in net benefit: beyond the level warranted by the legitimate local variation in an estate, further standardization reduces net performance, so the optimum level differs by estate (following Romero *et al*., 2015).

Propositions P2, P3 and P7 carry the coupling argument, on which the framework's distinctive claim stands or falls.

6. Application: A Hypothetical Illustration

This section is a hypothetical illustration constructed to make the framework concrete. It is not a case study: no organization is described and no data are reported. The setting is an imagined mid-sized services organization processing high-volume, document-heavy casework: intake, eligibility assessment, document verification, decision issuance, and reporting to management and an external regulator.

Layer 1. The analyst would begin with the case entity. In a hypothetical estate of this kind, "application", "case" and "file" may be used interchangeably while denoting different things in different systems: a submitted form, a bundle of submissions, or a work item created on assignment, so that intake volumes reported to management and to the regulator may differ legitimately. The Layer 1 artefacts are a published definition of the case entity and its lifecycle states, and metric specifications stating what is counted, over what period, on what date basis, and with what exclusions. The fitness-for-use principle (Wang & Strong, 1996) supplies the test: the definition is adequate when management and regulator can each use the figure for their own purpose without silently redefining it.

Layer 2. Eligibility assessment and document verification are the decision points. The analyst would name each, enumerate its inputs and permitted outcomes (approve, refuse, request further information, escalate), then externalize the logic into a decision model held separately from the process model (Hasić *et al*., 2018; Object Management Group, 2021); work to be expected as necessary rather than already done (Batoulis *et al*., 2015). Determinacy would then be assessed, for instance by having identical evidence bundles assessed independently, and each decision point classified as determinate, judgement-bearing, or drifting. One would expect document verification to be the more determinate; the framework's point is that this must be tested, not assumed.

Layer 3. The workflow layer then addresses sequence, handovers, routing of information requests, and the exception taxonomy. If the hypothetical organization operates several intake channels, the framework asks whether those variants are legitimate or residual and requires each survivor to carry a justification. Profile C or F in Table 4 is the likely reading for such an estate, with models drawn under stated guidance (Mendling *et al*., 2010) and, where work is genuinely non-sequential, in case-management notation (Object Management Group, 2016).

Layer 4. The reporting layer defines the reporting objects; say a monthly management pack and a periodic regulatory return, stating for each what it counts using the Layer 1 specifications, who receives it, and what decision it supports (Neely *et al*., 1995). The production path is documented so that any published number can be reconstructed; given the error rates reported for spreadsheet work (Panko, 1998, 2016), the control is reconciliation and independent review. A presentation convention is adopted (Hichert & Faisst, 2022), and whether improved reporting changes decision behavior remains open (Popovič *et al*., 2012).

What the coupling does here. Suppose the organization begins at Layer 4, because the regulator has queried a return. It rebuilds the production path; because "completed" is still defined differently by operations and reporting, the rebuilt path delivers a figure that continues to disagree with the operational view. Suppose instead it begins at Layer 3: conformance improves, while refusal rates continue to vary by assessor because the criterion was never externalized. Only when Layers 1 and 2 are addressed does reporting acquire a stable referent; and only then does the question of which decisions could be specified tightly enough to automate become answerable, since the answer depends on measured determinacy (Dumas *et al*., 2022). Again, none of this describes an actual organization.

7. Discussion

7.1. Implications for practice

The framework changes what a business analyst produces. Conventional practice already prescribes elicitation, modelling and requirements artefacts (International Institute of Business Analysis, 2015), with normative guidance on what makes a specification well formed (International Organization for Standardization, 2018). RDWS adds three obligations.

First, the analyst produces a definitional artefact before a process artefact: a project that begins with process mapping begins one layer too high, and the glossary is a control other artefacts reference, not an appendix.

Second, the analyst separates decision from flow as a matter of routine: for each process, an inventory of decision points with inputs and permitted outcomes, and a decision model maintained apart from the process model, extracting logic where existing models embed it in gateways (Batoulis *et al*., 2015). This changes the shape of the deliverable set, not merely its content.

Third, the analyst treats reporting as a process with a specification: a report request becomes a specification of a reporting object, purpose, definitions, production path, reconciliation checks, and presentation convention.

Two consequences follow. One is sequencing: where investment is constrained, the return is higher at lower layers, because that is where the specification gap is narrowed rather than merely encountered. The other is diagnostic honesty about judgement. Asking whether a decision point is determinate is politically awkward, since it invites the finding that expert variation is not expertise; the framework's position is that this is the analyst's question to ask, and that the right response to low determinacy is not always a rule for genuinely judgement-bearing decisions the correct output is documented criteria, evidence requirements and escalation paths. Benefits, finally, arise from the organizational change these artefacts enable rather than from the artefacts themselves (Melville *et al*., 2004; Ward & Daniel, 2012). In benefits-realization terms the artefacts are enablers whose value depends on competences that persist beyond the program (Ashurst *et al*., 2008; Doherty *et al*., 2012): an organization that produces a glossary and a decision model and then disbands the team maintaining them has bought an artefact, not a control.

7.2. Implications for research

The propositions require measurable constructs, and the least developed is determinacy; operationalizing it is the first item on the validation agenda. One design would present identical, de-identified input bundles to multiple assessors and compute inter-assessor agreement per decision point; a second would use retrospective execution records to compare outcomes across cases matched on recorded inputs, cheaper but confounded by unrecorded inputs. Establishing which measure predicts what is itself a contribution to be made. The construct matters beyond this paper because automation selection criteria already rely on determinism alongside frequency (Dumas *et al*., 2022) and on the boundary between rule-based and model-based approaches (Ng *et al*., 2021), without a general organizational measure of it.

The rubric in Table 2 requires validation as an instrument: inter-rater reliability across independent assessors of the same estate, and construct validity against established information-quality instruments (Lee *et al*., 2002; Nelson *et al*., 2005). The maturity progression in Table 3 warrants the scrutiny maturity models generally deserve, since the form invites an assumption of a desirable monotonic path the evidence does not support (Schäfermeyer *et al*., 2012; Romero *et al*., 2015).

The coupling propositions (P2, P3, P7) are the most valuable and the hardest to test. A cross-sectional survey could establish association: measure layer states with the rubric, measure conformance and outcome variance separately, and test whether L2 moderates the L3–outcome relationship; establishing sequence would require longitudinal or multiple-case designs. Staged preconditions have been expressed elsewhere as readiness levels for data; a preprint never formally peer-reviewed (Lawrence, 2017), and as organizational readiness factors derived from expert interviews (Jöhnk *et al*., 2021); a useful cross-check would be whether estates rated high on RDWS Layers 1 and 2 also rate high on such constructs. Two further avenues are worth naming: whether standardization artefacts jointly owned across the operations–reporting boundary survive longer than artefacts owned by one function (Carlile, 2004; Star & Griesemer, 1989); and whether externalized decision logic improves an organization's capacity to answer a regulator, connecting to the accountability dimensions identified in a synthesis of 242 articles, 93 of them core, covering 2008 to 2018 (Wieringa, 2020).

7.3. Positioning against the maturity-model and capability literature

The maturity progression in Table 3 takes a familiar form, and that form carries obligations. The proliferation of such models is documented: Van Looy (2014) classified 69 existing business process maturity models and introduced a selection tool, and Van Looy *et al*. (2017) established a well-founded, ranked and weighted set of critical criteria for such models that are most important to prospective users. The marginal contribution of a further ladder is therefore low unless it isolates something existing ones do not; Table 3 is offered on that basis, describing a *combined reporting-and-decision estate* and inheriting its level structure from the tradition (de Bruin & Rosemann, 2005; Hammer, 2007; Rosemann & vom Brocke, 2014).

The capability view (Rosemann & vom Brocke, 2014) supplies what a layer-based ladder does not, locating strategic alignment, governance, methods, information technology, people and culture as the elements a process program requires; empirical work in that tradition associates several directly with performance, culture particularly (Kohlbacher & Reijers, 2013), and culture is measurable through a validated instrument (Schmiedel *et al*., 2014). RDWS says nothing about culture or strategic alignment and is complementary rather than rival, decomposing the *artefact and evidence* dimension in more detail and sharing only governance (Spanyi, 2010).

Two cautions follow. Higher effort cannot compensate for higher complexity (Schäfermeyer *et al*., 2012) and full unification is frequently impractical (Romero *et al*., 2015), so the ladder describes the state of a standardization system rather than prescribing a target, the qualification entered in Section 5.8 and formalized in P8. And maturity models are commonly published without empirical validation; the progression offered here is in exactly that condition and is labelled accordingly.

7.4. Cross-domain generality

Section 3 and the framework meet at one point. In every domain surveyed there, the remedy proposed is an artefact that is, a framework, a model, an architecture, a dashboard, and in almost none is it accompanied by a statement of what the underlying terms mean or of how consistently the decision beneath it is taken. The framework's contribution is not a further artefact but an ordering: which artefact is load-bearing for which failure, and the rule that an artefact above an unstable layer inherits the instability. The claim is bounded twice. Generality of a *problem* is not generality of a *solution*, and the interdisciplinary evidence on intelligent automation in knowledge and service work is spread across fields with incompatible framings, so no consistent cross-domain synthesis of effects is available (Coombs *et al*., 2020). And success and failure are enacted rather than read off, so one program can be sincerely described as both within one organization (Cecez-Kecmanovic *et al*., 2014); a further reason the propositions in Section 5.11 specify observable artefacts and measured outcome variance rather than perceived success.

7.5. Boundary conditions: where the framework does not apply

Four boundary conditions are stated here, each grounded in literature reviewed in Section 2.

The first is the character of the work. Where a process is knowledge-intensive; knowledge- and data-centric, requiring substantial flexibility at design time and run time (Di Ciccio *et al*., 2015), imperative standardization of the sequence is standardizing the wrong object, and the appropriate instrument is constraint-based (Pesic *et al*., 2007) or a case-management paradigm distinct from workflow management (Marin *et al*., 2016; Object Management Group, 2016). The layers survive this shift unevenly: Layers 1 and 4 are unaffected, Layer 2 changes form from rules to criteria and evidence requirements, and Layer 3 changes object from a sequence to a set of constraints and permissible states. Where an organization cannot make that translation, RDWS is the wrong instrument and should be set aside rather than diluted.

The second is complexity: higher standardization effort cannot compensate for higher process complexity (Schäfermeyer *et al*., 2012), a ceiling no amount of layering escapes, beyond which the correct decision is to accept a plural estate and standardize only the definitional base and the reporting layer above it. The third is the legitimacy of variation: where it arises from law, market, channel or genuine professional judgement, unification is impractical and often counterproductive (Romero *et al*., 2015), and the appropriate configuration is contingent rather than fixed (Zelt *et al*., 2019). Determinacy makes that distinction empirical rather than political but does not resolve it: a decision point may be low in determinacy for good reasons, which should be recorded and owned rather than corrected.

The fourth is the limit of codification. Knowing has been characterized as an ongoing accomplishment enacted in practice rather than a stock transferable by documentation (Orlikowski, 2002), a counterweight to any codification-first program, including this one. The framework claims only that where the same inputs reliably produce the same outcome, that regularity can be stated and owned, and that where they do not the organization should know it. A fifth condition is a scope limit rather than a boundary: the framework addresses standardization, not redesign, so where the correct intervention is to eliminate the process it will produce a well-governed description of work that should not be done, and improvement methods give weak guidance for surfacing that possibility (Vanwersch *et al*., 2016).

8. Limitations

This is a conceptual paper presenting no primary data, no case study, no survey and no evaluation. Nothing in it is evidence that adopting the framework improves any outcome; the propositions in Section 5.11 are hypotheses awaiting test.

The framework was developed from published literature read against professional practice, by a single author. Single-author construct development risks coherence achieved at the expense of coverage: the layers are mutually consistent partly because one mind imposed them. Independent construct elicitation would be a stronger basis and was not attempted.

The empirical standardization literature on which Layer 3 rests is concentrated in large-firm and outsourcing contexts: a recruitment process (Münstermann *et al*., 2010; Muenstermann *et al*., 2010), outsourcing ventures in German banking (Wüllenweber *et al*., 2008), and surveys of experts (Schäfermeyer *et al*., 2012). Transfer to mid-sized, regulator-facing casework organizations of the kind used in Section 6 is an assumption, not a finding; the framework extends that literature by argument, not by evidence.

The reporting-quality literature predates the current generation of analytics tooling. The data warehousing studies (Wixom & Watson, 2001; Nelson *et al*., 2005), the assessment methodology (Lee *et al*., 2002) and the foundational quality framework (Wang & Strong, 1996) were developed in materially different technical environments, and the assumption that their conceptual claims survive changed tooling has not been re-tested. The end-user-computing error evidence (Panko, 1998, 2016) comes from laboratory experiments and field audits whose generalization to any particular reporting estate is unestablished. Costs of poor data quality are cited at the level of principle only (Redman, 1998); no cost figure is asserted.

The wider evidence base assembled in Section 2 carries its own limits, and widening it has not made the framework better evidenced. The comprehension literature is predominantly experimental, conducted on models built for the study (Figl, 2017; Reijers & Mendling, 2011). The evidence on improvement methods is sector-specific: an outpatient department in one instance (Gijo & Antony, 2014) and a single-sector review in another (McDermott *et al*., 2022). The compliance literature is unevenly distributed across the lifecycle (Hashmi *et al*., 2018), and process performance measurement supplies indicator catalogues and formal definition notations (del-Río-Ortega *et al*., 2019; Van Looy & Shafagatova, 2016) but no evidence that formally defined indicators change what managers do. The business intelligence evidence is largely cross-sectional and perceptual, and the strongest firm-level estimate available here comes from an unrefereed working paper (Brynjolfsson *et al*., 2011) that cannot establish direction of causation; the success dimensions used at Layer 4 (DeLone & McLean, 1992, 2003; Petter *et al*., 2008) are a measurement scaffold, not a finding. The data governance material derives from large firms and telecommunications settings (Abraham *et al*., 2019; Otto, 2011; Weber *et al*., 2009), whose scale differs from the illustrative setting used in Section 6.

Three references require a further caveat. The claims that standard operating procedures function as deliberate management instruments in small firms (Eyetsemitan *et al*., 2022), that coordination across parties sharing accountability requires an explicit governance-alignment mechanism (Eyetsemitan *et al*., 2020), and that reconciliation weaknesses are addressed by redesigning the underlying workflow (Dogbatsey *et al*., 2019) come from venues whose editorial and peer-review standards this paper has not independently assessed. Each is cited for a conceptual position only; none supports a statistic, and readers who discount all three will find no claim in the paper that depends on them.

A further limitation concerns the composition of the evidence base, and it is now a substantial one. Approximately thirty per cent of the reference list, the applied material clustered in Section 3, together with the three references noted above, consists of applied and practitioner contributions in venues without an established peer-review record, whose editorial and review standards this paper has not assessed. They are cited for illustration and for the conceptual positions their titles assert, and Section 3.1 states the terms on which they are used. No theoretical construct and no quantitative claim in this paper rests on any of them: no statistic, percentage, sample size or effect estimate anywhere in the paper is drawn from that material; no proposition in Section 5.11 depends on it; and none of the four layers, the coupling argument, the rubric, the maturity progression, the degree heuristic or the information-quality mapping would change if every one of those references were removed. A reader who wishes to assess the paper on peer-reviewed evidence alone should read Sections 2, 5 and 7 and disregard Section 3 entirely; the argument is designed to survive that reading.

Three scope limits should also be stated. The framework addresses standardization, not redesign: it says nothing about whether the standardized process is the right process. It treats the political economy of standardization, that is, who loses discretion, and how that is negotiated, as outside its scope. And the notations it references (Object Management Group, 2014, 2016, 2019, 2021) have themselves been questioned in practice (Recker, 2010); the framework depends on the principle of separation, not on any particular notation.

9. Conclusion

This paper has argued that process standardization and reporting standardization are one problem addressed by two disciplines that rarely meet, and that the seam between them is where organizational effort is lost. The RDWS framework treats them as a single object with four layers: definition, decision, workflow and visibility, each with a standardization object, an evidencing artefact and a characteristic failure mode. Its central claim is the coupling between layers: reporting cannot be standardized above unstable definitions, workflow standardization does not deliver outcome consistency without decision standardization, and the decision layer is the one organizations most often skip.

Alongside the framework, the paper contributes an assessment rubric, a five-level maturity progression qualified by the evidence that standardization is not uniformly desirable, a degree heuristic, eight propositions for evaluation, and determinacy as the diagnostic property of the decision layer.

An organization cannot specify what is not stable, and cannot automate what it has not specified; the specification gap is closed, if it is closed at all, from below. Standardization of decision logic and of reporting is therefore not a preliminary tidying exercise but the precondition for what follows, including the requirements and readiness work the author is developing separately. What this paper offers is a structure for that precondition and an agenda for testing whether it holds.

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