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Review Article

An Integrative Review of Operational Efficiency Mechanisms Across Industries

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***Abstract*:** This review examines how standardization, once embedded in digital systems, is translated into operational efficiency across markedly different industries, an inquiry that arose less from a single theoretical starting point than from a practical puzzle encountered during preliminary reading. The literature assembled here spans traditional Chinese medicine health preservation, enterprise resource planning and warehouse integration, direct-to-consumer brand marketing, and infrastructure project financial governance; such heterogeneity initially appeared to resist coherent synthesis, and the analytical framework was revised several times before a workable organizing logic emerged. Rather than treating these domains as commensurable cases, the review treats them as varied sites in which a similar mechanism standard articulation, system encoding, efficiency measurement may or may not operate in comparable ways. Evidence suggests that finer standardization granularity is often associated with smoother digital translation, although the relationship appears non-linear and may reverse once standards become too rigid for frontline adaptation. Efficiency metrics, moreover, tend to privilege quantifiable outputs while leaving the quality of the standards themselves largely unexamined, a possible blind spot in current evaluation practice. These findings are provisional; the cross-industry comparison rests on secondary sources of uneven depth, and causal claims cannot be sustained. Further research is needed to test the proposed mechanism empirically within single industries before broader generalization is attempted.

Keywords: *Standardization; Digital Systems; Operational Efficiency; Cross-Industry Review; Organizational Governance;*

1. Introduction

The relationship between standardization and operational efficiency has, for some time, been treated as a settled matter in management discourse—standards are presumed to reduce variance, and reduced variance is presumed to yield efficiency. This review begins from a degree of skepticism toward that presumption, not because it is obviously wrong, but because the mechanism connecting the two is rarely examined in cross-industry perspective. When one moves between fields as disparate as traditional Chinese medicine (TCM) health preservation, enterprise resource planning, direct-to-consumer brand marketing, and infrastructure project finance, the question of what "standardization" actually names, and of how standards become operational, turns out to be considerably less uniform than the settled view implies.

A second motivation is methodological. The literature relevant to this question is scattered across journals that seldom cite one another, and an integrative review must therefore confront the problem of incommensurability directly rather than papering over it. Preliminary attempts to organize the material by industry produced a fragmented account in which each section read as a

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self-contained mini-review; organizing by mechanism, by contrast, allowed recurrent patterns to surface, though at the cost of some contextual richness. The framework adopted here, standard articulation, system encoding, efficiency measurement, and governance risk—is the result of that adjustment, and it should be understood as a heuristic rather than a definitive taxonomy.

The review therefore proceeds in four analytical movements. It first examines how standards are articulated in different sectors and what kinds of work that articulation performs. It then considers how standards are encoded into digital systems and what is gained or lost in that translation. A third movement turns to efficiency measurement and the biases embedded in prevailing metrics . The fourth addresses governance and risk, where the limits of standardization become most visible. A concluding section reflects on what the cross-industry comparison does and does not establish.

2. Standard Articulation Across Sectors

The articulation of standards is never a neutral act of description; it is a selection of what will count as correct practice, and the selections made in different sectors reveal quite different underlying logics. In TCM health preservation, Chen's construction of a standard system for traditional external therapy proceeds through expert consensus and documentary analysis, with the explicit aim of rendering technical procedures reproducible across sites [19]. The methodological choice is understandable, yet it raises a question the paper does not fully resolve: consensus-based standards may reflect the distribution of expertise within the consensus group as much as they reflect clinical effectiveness, and the possibility that certain lineage-specific practices are advantaged or disadvantaged by the process cannot be excluded. This is not a defect peculiar to TCM; it is a general feature of consensus standardization that becomes more consequential where the evidence base is thin.

In the enterprise systems domain, by contrast, standards are articulated with reference to technical interoperability rather than clinical consensus. Qiu's work on technical standard development for cross-industry data integration in enterprise-level ERP systems [20] and the earlier analysis of ERP–WMS integration for inventory turnover [2] both treat standards as infrastructural prerequisites, conditions that must be met before systems can communicate at all. The logic here is closer to engineering than to consensus: standards are justified by what they enable, and their adequacy is assessed by whether integration succeeds. This difference in justification is important, because it suggests that the apparent convergence on "standardization" as a solution may conceal divergent criteria of success. A standard that satisfies interoperability requirements may be silent on the quality of the practices it coordinates.

Marketing informatization offers a third variant. Lu's three-dimensional standard framework for brand marketing informatization [23] attempts to specify standards at a level of abstraction that can accommodate diverse brand contexts, which is both its strength and its weakness—abstraction permits breadth but may attenuate the standard's capacity to guide concrete decisions. The framework's industry adaptation discussion acknowledges this tension without resolving it, and one is left uncertain whether the three dimensions are meant to be prescriptive or merely descriptive.

Considering these differences, the cross-sector comparison suggests that "standard articulation" is better understood as a family of practices than as a single practice. The family resemblance is real, all involve codification and all claim to improve coordination, but the criteria by which codification is judged successful vary substantially, and this variation may to some extent explain why cross-industry lessons about standardization travel poorly.

3. System Encoding and Digital Translation

If standard articulation is a family of practices, the encoding of standards into digital systems introduces a further set of translations, each with its own potential for distortion. The most explicit treatment of this problem appears in the enterprise platform literature. Shi's research on digital operation systems and efficiency evaluation for enterprise service platforms [12] and Zeng's analysis of digital operation modes in the comprehensive service industry [1] both describe architectures in which standardized processes are embedded in platform logic. What is striking about these accounts is the relative silence on what happens when a standardized process encounters a case it was not designed for. Platform architectures, by their nature, handle exceptions poorly; the encoding of standards may therefore improve efficiency for typical cases while degrading performance for atypical ones, a trade-off that aggregate efficiency metrics are unlikely to capture.

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The physical-store literature makes a related point from a different angle. Zeng's work on private-domain traffic operation for physical stores [13] and Jingye's full-process digital control model for multi-business stores [14] both emphasize the integration of online and offline operations, and both confront the difficulty that store-level practices are often tacit and resistant to formalization. The digital control model, in particular, appears to assume a degree of process standardization that may not obtain in practice; where it does obtain, the model's value is evident, but where it does not, the model may impose a structure that frontline staff work around rather than with. This is a possibility rather than a demonstrated finding, and further research observing actual implementation would be needed to assess it.

The TCM case offers a particularly instructive contrast. Yao's smart wellness model integrating TCM health preservation industry standards with digital systems [21] attempts to encode standards whose underlying logic is syndrome differentiation, a form of reasoning that is individualized by design. The encoding challenge here is arguably more severe than in enterprise systems, because the standard itself contains within it a mandate for contextual adaptation. Whether digital systems can preserve this adaptive capacity, or whether they inevitably flatten it into algorithmic rules, is an open question; the paper describes the model's architecture but does not, on its own, establish that the adaptive character of TCM reasoning survives the translation.

4. Efficiency Measurement and Its Biases

The measurement of operational efficiency is where the analytical framework becomes most vulnerable, because the metrics available tend to be those that digital systems can readily produce rather than those that best capture value. In the infrastructure finance literature, Chen's evaluation of capital efficiency in public infrastructure projects [15] and the empirical analysis of engineering–accounting integration for reducing cost-related financial losses [16] both work with quantifiable cost and capital variables, which is appropriate to their purpose but leaves unexamined the question of whether cost efficiency and project quality move together. It is possible that cost-focused efficiency metrics reward under-provision of quality in ways that only become visible over longer horizons, and the cross-sectional character of much of this literature makes such long-horizon effects difficult to detect.

The enterprise platform literature exhibits a similar pattern. Shi's efficiency evaluation framework for enterprise service platforms [10] and Chuan's analysis of platform strategy and industrial resource integration [11] both rely on metrics that privilege throughput and utilization. These metrics have the virtue of comparability, but comparability is purchased at the cost of sensitivity to the qualitative dimensions of service—responsiveness, customization, reliability under stressthat may matter more to users than the metrics reveal. This is not an argument against quantitative efficiency measurement; it is an argument for treating such measurement as partial.

The DTC brand literature adds a further dimension. Jin's analysis of short-video content narratives shaping user mental models [6], the KOL influencer matrix marketing study [7], the "content-seeding-conversion" closed-loop model [8], and the mixed empirical study of live-streaming e-commerce and KOL collaboration [25] all measure efficiency in terms of conversion rates and user engagement. These metrics are well suited to platform environments, where behavior is continuously logged, but they may conflate attention with intention and intention with purchase in ways that overstate the causal power of content strategy. Meiying's related work on the evolution of the closed-loop model [8] is attentive to this issue, though the empirical basis for distinguishing genuine conversion effects from platform-driven attribution remains thin.

Considering the above factors, the measurement of operational efficiency appears to be less a technical problem than a problem of judgment about what matters. The metrics in use across these industries are not wrong, but they are selective, and their selectivity tends to favor what is easily counted over what is substantively important. Further research might usefully examine how organizations reconcile multiple, partially conflicting efficiency metrics in practice, rather than assuming that a single metric adequately represents performance.

5. Conclusion

What the cross-industry comparison ultimately establishes is less a general law of standardization and efficiency than a set of recurring tensions that any standardization effort must negotiate, tensions that reappear, in different guises, whether one is

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codifying a traditional therapy, integrating an enterprise system, standardizing a marketing process, or governing an infrastructure project. The tension between codification and adaptation, between measurable output and substantive value, and between system-level coordination and frontline discretion is not resolved by better standards or better systems; it is relocated, and sometimes concealed, by them. This suggests that the practical significance of the present review lies less in any recommendation it can offer than in the questions it makes available for further inquiry: how standards might be designed to preserve adaptive capacity rather than merely to constrain it, how efficiency metrics might be held accountable for what they omit, and how governance arrangements might be structured to detect the forms of degradation that standardization itself may produce. Whether such arrangements are feasible is an empirical question, and one that the literature reviewed here is not yet in a position to answer. What can be said with some confidence is that the relationship between standardization and efficiency is mediated by institutional and organizational conditions that vary substantially across contexts, and that cross-industry generalization must therefore proceed with caution, attentive to mechanism rather than to slogan, and open to the possibility that the most efficient arrangement is not always the most standardized one.

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Data will be made available on request.

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Conflicts of Interest

The author(s) declare no conflicts of interest.

Ethical Approval and Consent to Participate

Not applicable.

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