

From Rigid Control to Intelligent Governance: The Logic of Institutional Innovation in the "Internet Plus" Platform of State-Owned Design Institutes

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Abstract: With the rise of the global digital economy, the digital transformation of state-owned design institutes has become imperative. Traditional institutes face challenges such as rigid management structures, repetitive low-value tasks, and inefficiencies in procurement and supplier management. This study proposes an innovative "Internet Plus" platform framework to bridge the gap between regulatory compliance and operational agility. The framework integrates five core institutional innovations: regulatory compliance, process reengineering, demand structuring, supplier capability profiling, and incentive alignment. Through a pilot program at a state-owned design institute, the study demonstrates that this approach enhances operational efficiency, reduces costs, and mitigates risks while adhering to institutional constraints. The findings contribute to the broader agenda of digital transformation in state-owned enterprises, offering a replicable model of "SOE-Compliant Agility."

Keywords: Digital Transformation; Internet Plus; State-Owned Enterprises; Design Institutes; Institutional Innovation; Compliance and Agility

1. Introduction

With the rise of the global digital economy, the digital transformation of central and state-owned enterprises has become an operational necessity. In the engineering design sector, traditional institutes are constrained by rigid management structures and large volumes of repetitive, low-value tasks, such as reinforcement drawing and 2D-to-3D conversions, which limit engineers' focus on high-value activities like simulations and complex design analysis [1]. Meanwhile, growing project complexity, stricter

sustainability requirements, and compressed schedules intensify resource pressures and amplify inefficiencies. Although digital technologies such as BIM, digital twins, and integrated project delivery have been shown to enhance collaboration and efficiency their adoption remains uneven. Current challenges include insufficient digital capabilities, entrenched management practices, and outdated procurement models, which collectively hinder design institutes from achieving the full benefits of digital transformation [2].

Therefore, this research employs Design Institutes operating under the framework of central and state-owned enterprises (CSEEs) as its primary case study. It conducts an in-depth analysis of how these institutes can transcend the constraints of conventional, often rigid workflows inherent in traditional design organizations [3]. The core objective is to forge an innovative operational mechanism specific to design services that harmoniously integrates regulatory compliance with operational agility and efficiency. The proposed approach entails constructing a robust compliance framework. This framework is designed to facilitate secure contracting for design tasks and enable dynamic oversight mechanisms within the specific regulatory constraints governing CSEEs [4,5]. Concurrently, leveraging principles of process re-engineering, the mechanism seeks to synthesize the inherent agility characteristic of internet platforms (represented by the "Internet Plus" model) with the rigorous quality control systems foundational to design institutes [6,7]. Central to this transformation is the establishment of sustainable incentive-compatible mechanisms [8]. These mechanisms are envisioned to align interests and stimulate collaborative value creation among both internal and external design resources participating within the newly formed platform

ecosystem [9,10]. The ultimate aim is to crystallize a replicable paradigm aptly termed "SOE-Compliant Agility"-bridging the compliance rigor of state-owned entities with the adaptive efficiency associated with internet platforms. Empirically, this integrated paradigm demonstrably fosters enhanced operational efficiency, significant cost reduction, and improved risk mitigation outcomes for CSEE-affiliated Design Institutes [11]. Crucially, it contributes constructively to the broader agenda of empowering state-owned enterprise (SOE) digital transformation [12].

2. Related Research

In the context of the global digital economy for the development of a digital nation, the digital transformation of central and state-owned enterprises has transitioned from a strategic consideration to an operational necessity [13]. The engineering design industry, serving as a fundamental pillar of infrastructure development, is currently experiencing unprecedented pressures to adapt and modernize. Digitalization is no longer viewed solely as a tool for efficiency enhancement; rather, it is increasingly recognized as a critical enabler for innovation, resilience, and long-term competitiveness [14]. Traditional design institutes face considerable challenges due to rigid human resource frameworks and entrenched management practices, which hinder their ability to respond effectively to dynamic demands. A substantial portion of their daily operations still consists of repetitive and standardized tasks, such as the preparation of reinforcement drawings and the conversion of two-dimensional designs into three-dimensional models [15]. These activities, often referred to as manual or low-value-added labor, occupy a disproportionate amount of technical professionals' time, thereby limiting their capacity to focus on higher-value tasks requiring specialized expertise. Empirical studies in knowledge-intensive sectors have shown that automation and digital tools can reduce time spent on routine design work by up to 40%, freeing engineers to concentrate on complex problem-solving and innovation.

Concurrently, the industry demands considerable intellectual labor, wherein designers must dedicate extensive effort to innovative problem-solving and complex technical analyses, including numerical simulations, system integration, and the drafting of comprehensive

reports and proposals. These tasks, inherently time-consuming and technically demanding, further strain already limited resources. The dual burden of repetitive manual work and cognitively intensive labor not only decreases productivity but also contributes to employee burnout and high turnover, which have been documented in engineering organizations facing digital transition.

Moreover, the increasing complexity of projects, coupled with heightened expectations for innovation and sustainability, has exacerbated existing operational challenges. Large-scale infrastructure projects often involve multiple stakeholders, sophisticated cross-disciplinary coordination, and stringent compliance with environmental and safety standards. Design institutes must now manage multiple projects simultaneously, navigate extended decision-making processes, and meet increasingly compressed deadlines. These circumstances have led to severe resource constraints and excessive workloads, highlighting a growing disparity between project demands and available capacity.

Against this backdrop, scholars and practitioners emphasize the urgency of reforming the traditional model of design subcontracting and procurement. Studies highlight that reliance on conventional procurement mechanisms, characterized by fragmented workflows, limited transparency, and weak collaboration. It has become a major bottleneck to efficiency. Emerging approaches, such as digital twin technologies, building information modeling (BIM), and integrated project delivery (IPD), are increasingly promoted as solutions to address inefficiencies by enabling real-time data sharing, collaborative decision-making, and lifecycle management of assets. These technologies not only streamline workflows but also lay the foundation for data-driven innovation, predictive analytics, and sustainability-oriented design.

In sum, existing research underscores that the digital transformation of design institutes is both an urgent necessity and a long-term strategic imperative. It requires not only technological upgrading but also structural reforms in organizational management, talent cultivation, and procurement mechanisms. Without such systemic changes, design institutes risk lagging behind in an era where digital intelligence and sustainable innovation are becoming the defining criteria for competitiveness.

3. Discussion on the Current State and Challenges of Design Institutes

3.1 Institutionalized Procurement Processes: Efficiency Collapse Under Multi-Level Approval Chains

The procurement systems of state-owned design institutes are experiencing significant institutional inefficiencies, primarily caused by structural delays resulting from excessive hierarchical approvals. Vertically, procurement requests must move through multiple administrative layers, including operational departments, specialized technical divisions, finance offices, and executive leadership, before final authorization is granted. Each stage introduces waiting periods, document transfers, and sequential checks that extend timelines well beyond operationally acceptable limits. In routine material procurement, for instance, the cycle of manual submission, review, and signature often consumes several weeks, far outstripping the actual time needed for supplier confirmation and delivery. Horizontally, the problems are equally pronounced. Technical specifications generated by design departments are often drafted in formats incompatible with procurement systems, requiring repeated manual transcription. This not only results in unnecessary duplication of work but also degrades the accuracy of critical information, leading to inconsistencies that suppliers must later clarify or revise. The cumulative effect is a workflow characterized by redundancy, error-proneness, and low transparency. Compounding these inefficiencies are risk control mechanisms that remain overly dependent on post hoc, paper-based verification. Instead of embedding preventive safeguards into early stages of procurement, current practices treat compliance as a matter of retroactive audit, reducing oversight to a formalistic exercise. As a result, true risk anticipation is neglected, leaving enterprises vulnerable to operational and financial exposure even while appearing compliant on paper.

This rigid process structure has generated a systemic vicious cycle. Repeated delays in urgent procurement cases force project teams to bypass official channels, resorting to temporary or non-standard purchasing methods. While such shortcuts may resolve immediate needs, they introduce substantial compliance and

accountability risks. At the same time, the heavy reliance on manual approval chains and extensive documentation inflates labor costs far beyond industry norms, creating a distorted cost structure. In large-scale or strategic projects, prolonged approval bottlenecks frequently cause shortages of key materials, undermining the enterprise's ability to deliver integrated services on time and eroding its competitiveness in the market.

At a deeper level, the paradox is stark: mechanisms originally designed to safeguard state-owned assets and ensure procedural rigor now obstruct the very efficiency and responsiveness required for sustainable growth. When procedural completeness and administrative control are prioritized above operational agility, the system falls into a self-defeating loop where more control yields less effectiveness. Breaking this cycle demands a fundamental restructuring of procurement mechanisms, one that streamlines processes, embeds proactive risk management, and aligns regulatory intent with the operational realities of design institutes.

3.2 Supplier Matching Failure: Structural Imbalance in Closed Resource Pools

Design institutes face severe structural dysfunction in supplier matching, rooted in the fundamental disconnect between closed resource pools and open market demands. Institutional entry barriers often prevent high-quality small and medium-sized enterprises, university research laboratories, and other specialized technical providers from participating, effectively narrowing the range of available expertise. Traditional recruitment methods, dominated by internal referrals and rigid public tenders, further constrain the breadth of supplier engagement and keep participation rates persistently low. This exclusionary structure not only limits the diversity of resources but also erodes the competitive pressure needed to drive supplier performance improvement. At the operational level, manual matching mechanisms remain mired in inefficiency and subjectivity. Procurement staff must interpret vague or ambiguously defined technical requirements, perform repetitive comparisons across fragmented information systems, and rely heavily on email and phone communications that lack standardization. Cost estimations are often constructed without robust data support, leaving

room for individual biases and arbitrary judgments. In practice, this produces chronic misalignment between project demands and supplier capabilities, as the process lacks both precision and scalability.

Over time, this supply-demand mismatch has developed into a triple vicious cycle. Technically, key projects are plagued by design rework, delivery delays, and cost overruns stemming from mismatched supplier competencies. Ecologically, the persistence of a closed resource pool stifles the integration of specialized expertise from emerging enterprises and academic institutions, weakening the institute's capacity for innovation and adaptation. Strategically, the heavy reliance on labor-intensive screening consumes significant organizational resources while failing to establish agile supplier networks capable of buffering against market volatility and policy shifts. The consequences are systemic. When certifications are treated as the sole entry requirement and experiential estimates substitute for scientific evaluation, supplier matching is reduced from a mechanism of value creation to a generator of systemic risk. High entry barriers produce resource deserts, while capability gaps undermine operational certainty. As a result, design institutes find themselves trapped in a paradox: even as urgent project demands escalate, vast reserves of external capacity and innovation potential remain untapped. In the broader context of digital transformation, this misalignment threatens not only procurement efficiency but also the strategic resilience of design institutes, leaving them increasingly vulnerable to market competition and technological disruption.

3.3 Supplier Management Failure: Risk Spiral Under Static Profiling

Contemporary supplier management systems in design institutes are plagued by profound risk governance failures, rooted in the structural gap between static supplier profiles and the inherently dynamic nature of operational risks. Current practices are confined to archival record-keeping, where business licenses, tax certificates, and qualification documents are filed and periodically reviewed. In this framework, paper-based checks substitute for substantive capability assessments, leaving critical blind spots. Historical performance data are rarely tracked or integrated, meaning that

patterns of quality defects, delivery delays, or contractual disputes cannot inform future decisions. Technological upgrades within suppliers go unnoticed, preventing institutes from recognizing partners who evolve their competencies. Even more critically, high-risk behaviors such as credential lending or subcontracting under borrowed qualifications often evade detection, undermining both compliance and safety. The problem is further compounded by systemic fragmentation. Supplier management systems frequently operate in isolation from enterprise-wide platforms such as ERP, BIM, and digital procurement portals. Without interoperability, key signals including financial instability, ownership restructuring, or litigation records fail to propagate across systems in real time. Information asymmetry deepens as procurement teams are forced to make high-stakes judgments based on incomplete or outdated profiles. What emerges is a static snapshot of supplier credentials, entirely divorced from the shifting operational realities in which risks accumulate and materialize.

This governance void precipitates cascading failures. In the absence of real-time monitoring, early warning systems for supplier risks remain nonexistent. Catastrophic events such as abrupt supplier bankruptcy or regulatory sanctions surface only after collapse has occurred, leaving projects exposed to irreversible disruptions. Quality assurance processes are equally compromised. When supplier evaluations do not incorporate dynamic performance metrics such as 3D modeling accuracy, defect ratios in delivered components, or timeliness of submissions, accountability dissolves into ambiguity. Suppliers may repeatedly underperform without consequence, while genuinely high-performing actors are indistinguishable within static credential archives. At the ecosystem level, vitality is systematically drained. The closed-loop nature of existing management systems restricts the entry of innovative and high-capacity suppliers, reinforcing adverse selection. Over time, the supplier pool becomes dominated by low-risk but mediocre participants who meet basic credential requirements yet lack advanced capabilities. Meanwhile, more dynamic and innovative players are excluded, unable to break through rigid entry barriers. This imbalance reduces competitive pressure, weakens

innovation incentives, and degrades the long-term adaptability of the institute's supply network.

Ultimately, the inversion of logic is striking. Risk management, conceived as a proactive safeguard, devolves into a passive liability. Archival storage displaces real governance, credential checks obscure genuine capability audits, and reactive crisis management substitutes for preventive strategies. Instead of enhancing resilience, the system amplifies vulnerability. In markets defined by uncertainty and complexity, such rigidity leaves design institutes structurally fragile, unable to anticipate disruptions, adapt to change, or sustain competitiveness.

4. The Institutional Innovation in the "Internet Plus" Platform

The emergence of the "Internet Plus" paradigm has introduced novel pathways for the transformation of design institutes. While third-party design crowdsourcing platforms (e.g., Zhubajie, Upwork) have demonstrated resource integration efficacy in domestic and international market-oriented contexts, their compatibility with the institutional mechanisms of state-owned enterprises remains fundamentally constrained. Regulatory mandates, such as the Supervisory Measures for Procurement in Central Enterprises and Procurement Standards for State-Owned Enterprises. It conflicts with the flexible subcontracting mechanisms of commercial platforms. Moreover, data sovereignty concerns impede deep integration with internal enterprise systems (e.g., ERP, BIM).

Against this backdrop, we have proposed an innovative "Internet-Enabled Design Institute" framework. This paradigm seeks to establish an intelligent subcontracting ecosystem embedded within state-owned institutional structures, with a focus on five core institutional innovations: (1) Regulatory Compliance: Establishing a framework to ensure secure subcontracting and dynamic oversight within state-owned enterprise constraints; (2) Process Reengineering: Integrating the agility of internet platforms with the quality control systems of design institutes; (3) Demand Structuring: Standardizing design outsourcing requirements according to industry norms to enhance procurement efficiency; (4) Supplier Capability Profiling: Developing systematic methods to match design needs with supplier competencies; (5) Incentive Alignment:

Creating sustainable mechanisms to foster value co-creation among internal and external design resources within the state-owned ecosystem. This study employs a strategic pilot program at a state-owned design institute as an empirical case, advancing a tripartite theoretical framework of institutional innovation, technological enablement, and organizational evolution (Figure. 1). The approach delineates a transformation pathway that simultaneously adheres to regulatory boundaries and harnesses the scale advantages of platform economics.

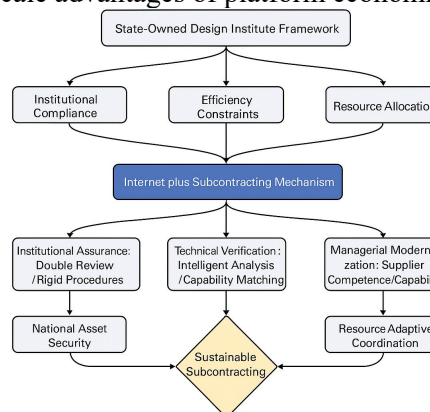


Figure 1. The Tripartite Theoretical Framework of Institutional Innovation, Technological Enablement, and Organizational Evolution

By embedding platform-based mechanisms within the governance logic of state-owned enterprises, the proposed framework offers several benefits. First, it bridges the longstanding divide between rigid regulatory requirements and the flexibility of market-oriented platforms, ensuring both compliance and adaptability. Second, it enhances operational efficiency by standardizing outsourcing processes and leveraging data-driven supplier profiling, thereby reducing transaction costs and improving the precision of resource allocation. Third, the integration of incentive alignment mechanisms cultivates a collaborative ecosystem in which internal teams and external partners co-create value, strengthening knowledge exchange and innovation capacity. Finally, by harnessing the scale effects of digital platforms while preserving enterprise-level data sovereignty, the framework provides a sustainable pathway for design institutes to modernize without compromising institutional integrity.

5. Conclusions and Prospectives

This study presents a transformative framework

for state-owned design institutes, combining the rigor of regulatory compliance with the flexibility of internet platforms. The proposed "Internet Plus" model addresses critical inefficiencies in procurement, supplier management, and resource allocation, demonstrating tangible benefits in operational efficiency and risk mitigation. Future research should explore the scalability of this model across different sectors and regions, as well as the integration of emerging technologies like AI and blockchain to further enhance platform capabilities. Additionally, longitudinal studies could assess the long-term impact of this framework on innovation capacity and market competitiveness. By continuing to refine and adapt this model, state-owned enterprises can better navigate the complexities of the digital economy while maintaining institutional integrity.

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