GOVERNING THE POST-CONSOLIDATION MEGA-CITY: LEGAL FRAMEWORKS FOR DIGITAL TRANSFORMATION IN DA NANG, VIETNAM

QUẢN TRỊ SIÊU ĐÔ THỊ HẬU SÁP NHẬP: KHUNG PHÁP LÝ VỀ CHUYỂN ĐỔI SỐ TẠI ĐÀ NẴNG, VIỆT NAM

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(Received: June 05, 2026; Revised: September 26, 2026; Accepted: October 15, 2026)

DOI: 10.31130/ud-jst.2026.24(10).388E

Abstract - This study evaluates the legal framework for digital transformation in local governance in Da Nang, Vietnam, following its administrative consolidation. Through the analysis of secondary documents and in-depth interviews across five stakeholder groups, the paper asserts that despite a successful transition toward an "enabling development" paradigm-driving the digital economy to account for 24% of the GRDP (in 2024)-the system remains constrained by five core bottlenecks. These include vertical regulatory misalignment, data siloing, rigid public finance, the absence of digital personnel standards, and the digital divide across regions. The study proposes a comprehensive matrix of solutions toward 2035, emphasizing regulatory sandboxes and public service co-production, while concurrently integrating green transformational leadership into grassroots administrative capacities. This research provides empirical implications for refining digital transformation laws within polycentric urban governance in emerging economies undergoing institutional transitions.

Key words - Digital transformation; local governance; legal frameworks; co-production; green transformational leadership

Tóm tắt - Nghiên cứu này đánh giá khung pháp lý về chuyển đổi số trong quản trị địa phương tại Đà Nẵng, Việt Nam sau khi sáp nhập đơn vị hành chính. Thông qua phân tích các tài liệu thứ cấp và kết quả phỏng vấn sâu 5 nhóm đối tượng, bài báo khẳng định: dù chuyển dịch thành công sang mô hình "kiến tạo phát triển" giúp kinh tế số chiếm 24% GRDP (năm 2024), hệ thống vẫn tồn tại 5 điểm nghẽn cốt lõi: độ vênh pháp lý dọc, cát cứ thông tin, tài chính công cứng nhắc, thiếu hụt tiêu chuẩn nhân sự số và hố ngăn cách số giữa các vùng miền. Bài báo đề xuất hệ thống giải pháp đến năm 2035, nhấn mạnh cơ chế thử nghiệm và đồng kiến tạo dịch vụ công, đồng thời, lồng ghép lãnh đạo chuyển đổi xanh vào năng lực quản trị cơ sở. Nghiên cứu cung cấp hàm ý thực chứng cho việc hoàn thiện pháp luật chuyển đổi số trong quản trị đô thị đa trung tâm tại các nền kinh tế mới nổi trong bối cảnh thể chế đang chuyển đổi.

Từ khóa - Chuyển đổi số; quản trị địa phương; khung pháp lý; đồng kiến tạo; lãnh đạo chuyển đổi xanh

1. Introduction

The proliferation of the Fourth Industrial Revolution has profoundly reshaped the structures and processes of national governance [1]. At the local level, where the government directly interacts with and addresses the essential needs of citizens, digital transformation has become an inevitable trajectory to optimize public service delivery and co-create social value [2], [3]. The paradigm shift from traditional administrative management to data-driven governance necessitates an enabling legal ecosystem; wherein, the law serves not merely as an instrument of control but as a foundational platform fostering participation and co-production [4], [5].

Although digital transformation presents immense potential, traditional legal frameworks frequently exhibit latency relative to the pace of technological advancement, creating a paradox between the imperative for innovation and institutional inertia [6]. In emerging economies undergoing transition, current studies predominantly focus on the application of technology or macro-level policy formulation [7], yet lack a systematic, empirical analysis of core legal barriers at the local tier [8]. Particularly, the scarcity of evidence regarding the adaptability of legal systems in the context of large-scale municipal consolidations leaves a substantial void in contemporary public administration literature.

This study selects Da Nang City (Vietnam) as an intrinsic case study to address the aforementioned gap. Da Nang is a pioneering locality in digital transformation, with its digital economy accounting for 24% of the GRDP in 2024 [9]. Notably, the city confronts a complex governance challenge: operating a polycentric mega-city following the complete administrative and demographic consolidation with Quang Nam province (effective July 1, 2025). This historic merger exerts immense pressure on the existing institutional system, starkly exposing the barriers arising from the rigidity of legacy regulations when juxtaposed with the velocity of digitalization.

To resolve the challenges inherent in a polycentric mega-city, the governance model must transcend purely technocratic approaches to embrace the Smart City 2.0 paradigm [10]. Furthermore, this process demands the integration of a sustainable development philosophy; wherein, harnessing green transformational leadership at the grassroots level is an absolute requisite to ensure harmony between technological modernization and social inclusion.

To methodologically address this gap, this study adopts

a qualitative case study design. We employ methodological triangulation, combining discourse analysis of secondary legal documents with a rigorous inductive thematic analysis of 25 semi-structured in-depth interviews.

The specific contributions of this paper are threefold: (1) providing empirical evidence on institutional barriers to digital transformation at the grassroots level in a post-consolidation context; (2) connecting the Smart City 2.0 and Twin Transition paradigms with local legal framework analysis; and (3) proposing targeted policy recommendations derived from the interplay between empirical findings and theoretical projections.

2. Theoretical framework

2.1. Local Governance and the Smart City 2.0 Paradigm

Modern public administration scholarship acknowledges a profound paradigm shift from "Local Government" to "Local Governance" [11]. According to network theory, local governance is no longer a unilateral, command-and-control operation by the state apparatus, but rather a complex system of multi-level relationships where power is shared and exercised through negotiation and synergy among the government, enterprises, and civil society [11], [12]. As digital technology permeates this governance structure, the "Smart City 2.0" paradigm has emerged, fundamentally rejecting the technocratic approach that views technology merely as an automation tool [10]. Smart City 2.0 is predicated on social inclusion and democratic participation; wherein, administrative data is regarded as a "public digital asset" paving the way for policy "co-production" models [13], [14]. To operationalize this paradigm, the legal framework must transition from "administrative control" to "ecosystem enablement", establishing jurisdictional boundaries to optimize experimental legislation within the urban governance space [13].

2.2. Enabling Digital Transformation Law and Structured Experimentalism

Digital transformation law is not a mechanical assembly of technology regulations, but a multidisciplinary normative system governing behaviors in the digital space based on the principle of "Regulation by Technology" [15]. Accordingly, algorithms and software architectures possess the capacity to regulate behavior equivalently to legal norms [16]. To resolve the paradox between the pace of technological change and the rigidity of positive law, the doctrine of "Structured Experimentalism" has become an essential theoretical foundation [17]. This doctrine advocates for the establishment of Regulatory Sandboxes, allowing state agencies to flexibly relax administrative rules within a confined space to audit the actual risks of emerging technologies [17], [18]. Concurrently with this openness, the legal system must build "Digital Trust" through the theory of "Informational Self-Determination" [19]. This right establishes the supreme capacity of the individual to control, configure, and limit data flows pertaining to them, mitigating the risk of citizens being manipulated by the public sector's big data systems [19].

2.3. The Twin Transition and the Role of Green Transformational Leadership

As modern cities strive toward sustainable development goals, the institutional system cannot approach digital policy in isolation. The current global trajectory emphasizes the "Twin Transition" - the absolute synchronization between urban greening objectives and the digitalization of the administrative apparatus [20]. Experiences from leading global cities like Oslo affirm that digital technology must act as a "connecting power" to mitigate carbon emissions, restructure public spaces, and automate energy management chains [21], [22]. To actualize this complex paradigm, legal regulations must act as a launchpad for local human resource governance capacities. The integration of ecological objectives into the digitalization process demands the robust presence of green transformational leadership at the grassroots level. A leadership cohort equipped with a green transition mindset will play a pivotal role in translating macro-legal frameworks into micro-actions, shattering the inertia of the bureaucracy, while ensuring that digital tools are deployed to minimize social vulnerability and sustainably protect the environment.

3. Methodology

3.1. Research Design

This study employs a qualitative case study design to conduct an in-depth analysis of a complex governance phenomenon within a real-world context. Da Nang City was selected as the quintessential case study as it converges all the elements of a leading digital transformation municipality, while concurrently undergoing large-scale restructuring following the total administrative boundary consolidation with Quang Nam province. This design facilitates a comprehensive dissection of the reciprocal impacts between macro-legal frameworks and micro-implementation capacities at the grassroots level.

3.2. Data Collection Methods

To ensure the multidimensionality and reliability of the data, the study applies methodological triangulation:

(i) Document and Content Analysis: Collecting and reviewing the system of legal normative documents, schemes, and strategic decisions (e.g., Scheme 3292, Decision 257) from the Central to local levels. This secondary data source provides a foundation to assess the comprehensiveness, synchronicity, and textual gaps within the legal system.

(ii) Semi-structured In-depth Interviews: Developing a standardized interview protocol to directly measure the maturity of the legal framework through the experiential lenses of actors directly executing and benefiting from the policies. The use of structured questions ensures direct cross-comparability among different target groups.

3.3. Sampling Characteristics

The research applies purposive sampling, systematically selecting 25 qualitative participants between November 15, 2025, and February 9, 2026. To ensure a comprehensive representation of the governance

ecosystem, the sample is stratified into five strategic cohorts: (i) Leadership and management civil servants under the commune-level People's Committee; (ii) Executive civil servants at the commune-level local government; (iii) Civil servants across provincial departments and agencies; (iv) Leaders of technology enterprises headquartered in the area; and (v) Resident citizens with actual experience using online public services. Notably, to evaluate the inclusivity of the law in the post-consolidation mega-city, the interviews purposively covered remote, ethnic minority regions (such as Tra Tap and Tra Lien communes) to gather empirical evidence on grassroots digital divides (see Table 1).

The final sample size of 25 was not arbitrarily predefined but rigorously determined by the principle of data saturation [23]. During the coding process, theoretical saturation was reached around late January 2026 (by the 20th interview), as no new substantial codes or themes regarding institutional bottlenecks emerged. The final 5 interviews, conducted in early February 2026, were utilized to definitively confirm theme stability. Regarding the cohort distribution, Group B consists of only 3 participants because this specific cohort strictly executes standardized administrative tasks, leading to rapid thematic convergence compared to the highly diverse managerial and advisory roles in Group C (7 participants). There were no refusals to participate among the invited subjects.

Table 1. *Classification and Coding of In-depth Interview Subjects*

No.	Target Group	ID Code	Quanty (n=25)
1	Leaders of units under the Da Nang commune-level People's Committee	A1-A6	6
2	Da Nang commune-level civil servants	B1-B3	3
3	Da Nang provincial-level civil servants	C1-C7	7
4	Leaders of enterprises headquartered in Da Nang	D1-D4	4
5	Da Nang residents with online public service experience	E1-E5	5

Source: (Authors' compilation)

Research Ethics: to ensure strict adherence to qualitative research ethics, all participants were fully informed of the study's objectives, their voluntary participation, and their right to decline or withdraw at any time prior to the interviews. Verbal informed consent was obtained from all 25 participants. To create a comfortable environment for the interviewees, audio recordings were not utilized; instead, researchers took detailed field notes of the key points during the sessions. These notes were subsequently expanded into comprehensive textual transcripts. Crucially, as an alternative form of documented consent and to ensure absolute data validity, a 'member checking' protocol was employed: the final transcripts were sent back to the respective interviewees for their review and formal confirmation before being utilized in the analysis. Finally, to strictly guarantee objective anonymity, all data underwent systematic alphanumeric coding (A1-E5).

3.4. Data Analysis Methods

To ensure methodological transparency and strict adherence to qualitative research ethics-pecifically the requirement for objective anonymity of participants-all data from the 25 in-depth interviews underwent systematic coding. The sample was assigned alphanumeric codes corresponding to the five established strategic strata. Specifically, commune/ward-level leadership and management civil servants were assigned the code A (e.g., the leader of Dien Ban Bac ward is A2; leaders of Tra Tap and Tra Lien communes are A5 and A6, respectively). Next, executive civil servants at the local government level were designated with the code B (e.g., B1 represents a specialist from Tien Phuoc commune). Similarly, advisory civil servants and experts from provincial departments were assigned the code C (e.g., representatives from the Department of Science and Technology are C2, C3, C6; Department of Finance are C1, C5; or the specialist from the City People's Committee Office is C7). Finally, technology enterprise leaders and resident citizens were categorized under codes D and E, respectively. This continuous identification system not only standardizes the thematic analysis process but also creates a transparent, rigorous traceability foundation for all empirical evidence presented in the findings and discussion sections.

The study applies a three-layered analysis process to ensure the reliability and scientific validity of the findings:

(i) Layer 1. Discourse Analysis: specifically used to comprehend and interpret the intrinsic meaning of relevant normative legal documents. This helps illuminate the paradigm shift in governance thinking, while identifying inherent legal conflicts or gaps between institutional documents regulating the local digital transformation process.

(ii) Layer 2. Content Analysis: applied to understand and explain the profound implications of the textual data. This technique focuses on identifying core concepts and establishing interactive relationships among themes within the data content, thereby providing a robust basis to build or reinforce the theoretical framework on local governance digital transformation.

(iii) Layer 3. Thematic Analysis: the primary method used to process qualitative data from the 25 in-depth interviews. Raw data was systematically coded (Table 1) to identify, analyze, and interpret recurring themes and motifs. This process accurately extracts practical "bottlenecks" from stakeholders' perspectives, creating an objective basis for comparison against the evaluation criteria for legal completeness.

4. Findings

4.1. Legislative Achievements and Institutional Paradigm Shifts

The discourse analysis of normative legal documents reveals a landmark transition in Da Nang's institutional system, shifting from a "management and control" mindset to an "enabling development" paradigm. This shift is codified through core documents such as Scheme 3292 on

creating momentum for socio-economic development (2026-2030) [9], the Digital Architecture Framework, and particularly Decision 257 on semiconductor and artificial intelligence (AI) development [24]. This enabling institutional framework has directly underpinned the locality's outstanding empirical achievements. Specifically, the provision rate of end-to-end online public services reached 95%, the completion rate of end-to-end online dossiers achieved 65%, and the digital economy contributed up to 24% of the GRDP in 2024 [9]. These results enabled the city to fulfill its strategic objectives two years ahead of schedule.

Table 2. *Analysis of Core Legal Frameworks for Digital Transformation in Da Nang*

Legal Document	Regulated Content	Progressive Aspects	Current Gaps *(Institutional Bottlenecks)*	Impact on Digital Transformation
Resolution No. 136/2024/QH15 [25]	Specifies mechanisms for urban governance, Da Nang Free Trade Zone, and strategic investments	Establishes a "Regulatory Sandbox" mechanism for testing new technologies and exempts civil servants from liability if acting objectively.	The macro-level liability exemptions lack detailed municipal decrees to be operationalized, causing hesitation among grassroots civil servants.	Empowers the mega-city to pilot unprecedented digital economic models and attract global tech giants.
Decision No. 3292/QD-UBND [9]	Master Scheme for Digital Transformation to promote socio-economic development (2026-2030, vision 2035).	Enforces a "Data Centric" paradigm; aims for the digital economy to reach 35-40% of GRDP by 2030. Integrates smart governance across all sectors.	Fails to synchronize with rigid traditional public finance laws regarding the valuation and procurement of intangible assets (e.g., AI algorithms, software).	Drives the comprehensive digitalization of the administrative apparatus, transforming it from "control" to "enabling development".
Decision No. 257/QD-UBND [24]	Strategy for developing the semiconductor and Artificial Intelligence (AI) sectors.	Prioritizes "AI First" and robust infrastructure (e.g., Lab-Fab, AI Data Centers) to integrate into the global tech value chain.	Highly technocratic; lacks synchronized provisions for standardizing "digital civil servant" quotas to manage these advanced tools at the commune/ward level.	Positions Da Nang as a national AI and semiconductor hub, but inadvertently pressures existing grassroots administrative capacities.

Source: (Authors' compilation)

4.2. Empirical Analysis: The Five Core Institutional Bottlenecks

Alongside prominent achievements, the thematic analysis of the 25 coded in-depth interviews exposed severe barriers in the operation of the digital government. The study synthesized five core institutional "bottlenecks" that directly constrain local governance efficiency.

First, severe regulatory friction has compelled the administrative apparatus to maintain parallel "paper-digital" processes. Empirical evidence from the leader of Dien Ban Bac ward (A2) indicates that certain sectors, such as land and construction, remain heavily dominated by legacy specialized laws from the Central government, which have not been amended promptly to synchronize with local digitalization speeds.

Second, despite the promulgation of the digital architecture framework, "information siloing" and horizontal interoperability disconnections among departments persist. Interview data from a specialist at the City People's Committee Office (C7) and the Department of Finance (C5) confirm that numerous units continue to prioritize their own sector-specific confidentiality regulations due to the absence of robust legal sanctions to enforce inter-agency data sharing.

Third, the third bottleneck stems from the rigidity of current public finance and investment mechanisms. According to experts at the Department of Finance (C1, C5), the existing expenditure normative rules remain bound by traditional public investment procedures, severely lacking appropriate standards for investing in and procuring intangible assets such as software or AI algorithms.

Fourth, regarding organizational structure, a bottleneck was identified in the absence of competency standards and job position frameworks for "digital civil servants". Feedback from an executive civil servant (B1) demonstrates that the lack of these specialized regulations has led to severe labor overload at the grassroots level.

Finally, field interview data in Tra Tap and Tra Lien communes (A5, A6) reflected the fifth bottleneck: the exacerbation of the digital divide in remote areas following administrative consolidation. This asymmetric polarization is a direct consequence of uniformly imposing a modern standard of end-to-end online services upon localities without the legal prioritization of commensurate infrastructure resource allocation mechanisms.

Table 3. *Thematic Matrix of Institutional Bottlenecks and Empirical Evidence*

Core Institutional Bottleneck	**Key Participants**	**Verbatim Quote (Translated)**
1. Vertical regulatory misalignment	A1, A2, A3, C2, C4, C6 (6/25)	"Many specialized laws, particularly in land and construction, are out of sync with digital processes, forcing us to maintain parallel paper and digital workflows" - (A2, Commune Leader)
2. Horizontal data siloing	A1, A4, B2, C3, C5, C7, D1, D3 (8/25)	"Currently, some departments still refuse to share data... creating information silos due to the lack of strong enforcement sanctions" - (C7, Provincial Official)
3. Rigid public finance mechanisms	A2, C1, C4, C5, D2, D4 (6/25)	"The biggest difficulty is the financial mechanism. Current public investment norms are extremely rigid when applied to pricing intangible assets like software or AI algorithms" - (C1, Provincial Finance Official)
4. Deficit in digital personnel standards	A3, A6, B1, B2, B3, C6, E2 (7/25)	"Grassroots civil servants are handling too many concurrent tasks. We critically lack standardized job positions and quotas specifically for 'digital civil servants'" - (B1, Commune Executive)
5. Regional digital divide (Post-consolidation)	A5, A6, E1, E3, E4, E5 (6/25)	"The telecommunications infrastructure up here is still weak... Imposing a 100% end-to-end online target in mountainous areas is completely impractical" - (A5, Leader of remote commune)

Source: (Authors' compilation)

To ensure transparency and provide robust qualitative evidence, the five institutional bottlenecks were

synthesized using thematic analysis. Table 3 illustrates the thematic mapping, frequency, and verbatim quotes extracted from the participants.

5. Discussion and Policy Implications

5.1. Discussion

The findings of this study provide crucial empirical evidence regarding the complex dynamics of digital transformation law within an institutional transition context. Da Nang achieving a digital economy share of 24% of GRDP and a 95% rate of end-to-end online public services demonstrates a successful shift from technocratic management to an "enabling development" or Smart City 2.0 paradigm [10]. However, the persistence of the five core institutional bottlenecks indicates that this transition remains constrained by structural barriers. Juxtaposed with the network governance theories of Stoker [11] and Pierre [12], the phenomenon of "information siloing" and vertical regulatory misalignment in Da Nang reflects a localized failure in harmonizing inter-agency institutions. Compared to Singapore's model, where the establishment of a centralized navigating agency eliminated fragmentation and resource isolation [14], Da Nang currently lacks a sufficiently robust legal enforcement mechanism to maintain horizontal cohesion. Similarly, the rigidity of public finance regarding intangible assets in Da Nang contradicts the State-led Data Marketization strategy successfully applied in Shanghai [26], where public data is codified into assets that can be valuated and traded. In particular, the asymmetric polarization and the digital divide in highland communes like Tra Tap and Tra Lien post-consolidation highlight the politics of urban inclusion [13]. Uniformly applying an end-to-end online service standard while ignoring disparities in infrastructure capacity and grassroots digital skills violates the equity principles of the Smart City 2.0 paradigm [10]. This necessitates that the law functions not merely as a technology promoter but as a safeguard for vulnerable populations, avoiding the creation of new inequalities in the enjoyment of public rights [27].

Consistent with Meijer & Bolívar [10] and Stoker [11], our findings confirm that transitioning to Smart City 2.0 requires profound institutional reconfiguration rather than mere technological deployment. However, a critical divergence emerges when comparing our context to fully developed nations. While studies in advanced smart cities like Zurich or Geneva [19] highlight data privacy and algorithmic auditing as their primary and immediate legal concerns, our empirical data reveals a different reality. In a transitional emerging economy context (such as post-consolidation Da Nang), basic legal synchrony-such as resolving vertical regulatory misalignment and public finance rigidity-remains the most severe and immediate barrier that must be dismantled before higher-order digital rights can be effectively governed.

5.2. Policy Implications

To thoroughly dismantle the identified structural barriers and advance toward sustainable development goals by 2035, local authorities must deploy a synchronized institutional solutions matrix. It is crucial to note that the following policy recommendations are derived not only directly from the empirical bottlenecks identified in Section 4.2, but are also theoretically projected through the lenses of the Smart City 2.0 and Twin Transition paradigms to ensure future-proof governance:

First, institutionalize structured experimentalism and protect innovation. The city must leverage the specific mechanisms under Resolution 136/2024/QH15 [25] to refine the legal framework for Regulatory Sandboxes, guided by Sunstein [28] and Zetzsche et al. [17]. Simultaneously, the City People's Council must enact specific regulations on liability exemption mechanisms to eliminate hesitation and encourage civil servants to implement innovation in their public duties.

Second, foster open data spaces and promote public service co-production. To terminate "data siloing", the law must transition from a mechanism of "encouragement" to "mandatory" interoperable data sharing, accompanied by stringent enforcement sanctions. Establishing an open data architecture will trigger public-private partnership models, facilitating the private sector's deep participation in co-producing smart urban services [13].

Third, refine Algorithmic Auditing mechanisms and accountability. Drawing governance lessons from leading cities like Zurich and Geneva, Da Nang must issue mandatory regulations on algorithmic auditing for AI systems applied in the public sector. Establishing clear boundaries for accountability will help forge robust digital trust among citizens, built upon the foundation of informational self-determination principles [19].

Fourth, bridge the digital divide and restructure the personnel system. The law must codify professional standard sets and establish a dedicated "digital civil servant" payroll quota at the commune/ward level to resolve current labor overloads. Crucially, for disadvantaged areas post-consolidation, priority must be given to allocating specialized budgets and maintaining a grassroots digital assistance network mechanism rather than rigidly imposing end-to-end online standards [22]. By establishing this dedicated quota, grassroots administrations can formally separate complex digital operations and data management tasks from traditional paperwork. This clear legal demarcation will directly relieve the administrative overload currently experienced by generalist civil servants, thereby significantly increasing the exactness and speed of public service delivery.

Finally, proactively prepare for the Twin Transition via Green Transformational Leadership. While not directly raised as an immediate regulatory barrier by the interviewees, anticipating the 'Twin Transition' (the absolute synchronization of digitalization and urban greening) is a theoretical imperative for the mega-city's 2035 vision [20]. To legally anchor this future trajectory, the institutional framework must begin integrating green transformational leadership criteria into grassroots administrative capacity standards. Cultivating this dual-

minded leadership cohort is a prerequisite to ensuring that future digital deployments do not merely automate tasks, but actively contribute to ecological sustainability without creating new vulnerabilities. This paradigm is strongly supported by recent local studies indicating that digital leadership and organizational agility are critical determinants of digital transformation readiness [29], and that robust regulatory frameworks are essential to controlling the associated financial risks during rapid digitalization [30].

6. Conclusion

This study fulfilled the objective of comprehensively evaluating the digital transformation legal framework in local governance in Da Nang, situated within the unique historical context following the administrative boundary consolidation with Quang Nam province. By transcending traditional technocratic management thinking to adopt the Smart City 2.0 paradigm and adaptive governance, the research affirms that digital transformation law is not merely a set of technology-regulating tools, but must be a multidisciplinary normative system characterized by enabling development. Empirically, the research results indicate that alongside national-leading achievements- enabled by the effective utilization of specific mechanisms from Resolution 136/2024/QH15 [25]- Da Nang's digital governance system remains hindered by five structural bottlenecks. These are the existence of parallel "paper-digital" processes due to vertical regulatory misalignment, inter-agency data siloing, the rigidity of public investment finance mechanisms regarding intangible assets, the void in "digital civil servant" titles, and the widening digital divide in newly merged mountainous communes. To thoroughly dismantle these barriers, the study proposed a strategic matrix of experimental legislative solutions for the 2026-2030 period, with a vision toward 2035. The key to unlocking new developmental space lies in configuring a sandbox legal framework integrated with public duty liability exemptions, codifying the "Once-only" principle, and promoting the public service co-production model. Notably, in the effort toward sustainable development and urban inclusion, integrating green transformational leadership into grassroots administrative governance capacity is a decisive factor for successfully spearheading the "Twin Transition" between digitalization and ecology. In terms of contributions, this work not only provides a direct scientific basis for policy formulation in Da Nang but also contributes a vital knowledge component to the governance theory of polycentric mega-cities in emerging economies. Although the study provided profound qualitative findings through the coded interview method of 5 strategic stakeholder groups, future research could expand the interviews scale using quantitative methods or conduct cross-case analyses with other mega-cities in emerging economies undergoing institutional transitions to enhance the reliability and generalizability of the proposed legal models.

7. Research limitations and future directions

While this study established a comprehensive analytical framework and provided highly practical policy implications, the work retains certain limitations requiring careful consideration.

Firstly, regarding methodology and generalizability barriers. The study was designed using a single case study method, focusing exclusively on the mega-city context of Da Nang following the administrative consolidation event. Although this approach allows for a profound dissection of localized institutional specifics and legal frictions, the empirical findings may be limited in external validity. The research results may not accurately reflect the governance structures of other localities or emerging economies with differing digital maturity levels and institutional configurations.

Secondly, regarding sample size and the nature of qualitative data. The study primarily established its arguments via thematic analysis based on 25 structured in-depth interviews. Although the interviews sample purposively covered five diverse stakeholder groups (from provincial leaders, grassroots civil servants, and enterprise leaders to citizens), this sample size is relatively small, and the analytical outcomes remain qualitative. Future research needs to be expanded through large-scale quantitative interviews to statistically test and quantify the impact magnitude of the five identified core institutional "bottlenecks".

Thirdly, regarding temporal limitations. This study evaluated the current state of law and governance capacity at a historic transitional juncture (the 2025-2026 period) based on the momentum of the Fourth Industrial Revolution. Given the exponential development speed of core technologies such as AI and semiconductors, the proposed solutions projected toward 2035 may require continuous refinement to align closely with reality. Stemming from this limitation, longitudinal studies are recommended to track and evaluate the implementation lifecycles of regulatory sandboxes, as well as to empirically verify the actual efficacy of the public service co-production model after the new normative frameworks officially enter operation.

Acknowledgement: This research is part of a university - level research project funded by The University of Danang - University of Economics, under the grant number T2025-04-55.

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