

ENHANCING DIGITAL COMPETENCE FOR CONSTRUCTION OFFICIALS IN THE DIGITAL GOVERNMENT ERA: FROM CURRENT TRAINING CONTENT TO SPECIALIZED CAPACITY-BUILDING ORIENTATIONS

NÂNG CAO NĂNG LỰC SỐ CHO CÔNG CHỨC NGÀNH XÂY DỰNG TRONG KỶ NGUYÊN CHÍNH PHỦ SỐ:
TỪ THỰC TRẠNG NỘI DUNG ĐÀO TẠO ĐẾN ĐỊNH HƯỚNG NHU CẦU BỒI DƯỠNG CHUYÊN SÂU

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Abstract: In the context of the Fourth Industrial Revolution, digital transformation is not only a technological trend but also an urgent requirement for innovating state management in the construction sector. This article evaluates the current state of training programs and materials and analyzes the digital competence needs of officials across 10 key management areas. By using legal-text analysis and empirical needs assessment, the study reveals that while the legal framework for digital transformation is relatively complete, existing training content still exhibits a significant gap regarding data-driven governance requirements. The paper proposes orientations for innovating training programs tailored to job positions and specialized fields, aiming to develop a workforce with a digital mindset and the ability to operate core technology platforms such as BIM, GIS, IoT, and Big Data.

Keywords: Digital transformation, civil servant training, construction sector, state management, digital competence.

Tóm tắt: Trong bối cảnh cách mạng công nghiệp lần thứ tư, chuyển đổi số không chỉ là xu thế công nghệ mà còn là yêu cầu cấp bách trong đổi mới phương thức quản lý nhà nước ngành Xây dựng. Bài báo tập trung đánh giá thực trạng hệ thống chương trình, tài liệu bồi dưỡng hiện nay và phân tích nhu cầu bồi dưỡng năng lực số cho công chức theo 10 lĩnh vực quản lý trọng tâm. Sử dụng phương pháp phân tích văn bản quy phạm pháp luật và khảo sát nhu cầu thực tiễn, nghiên cứu chỉ ra rằng: mặc dù khung pháp lý về chuyển đổi số đã tương đối hoàn thiện, nhưng nội dung bồi dưỡng hiện tại vẫn tồn tại khoảng cách lớn so với yêu cầu quản trị dựa trên dữ liệu. Bài báo

đề xuất các định hướng đổi mới chương trình bồi dưỡng gắn với vị trí việc làm và đặc thù của từng lĩnh vực chuyên môn, nhằm hình thành đội ngũ công chức có tư duy số và khả năng vận hành các nền tảng công nghệ lõi như BIM, GIS, IoT và Big Data.

Từ khóa: Chuyển đổi số, bồi dưỡng công chức, ngành Xây dựng, quản lý nhà nước, năng lực số.

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I. INTRODUCTION

The Fourth Industrial Revolution has fundamentally redefined the operational landscape of public administration. For governments seeking to enhance the effectiveness, transparency, and efficiency of state management, digital transformation is no longer an elective modernization initiative but a structural requirement. In Vietnam, this imperative has been institutionalized through landmark policy instruments: Resolution No. 52-NQ/TW of the Politburo (2019) on proactive participation in the Fourth Industrial Revolution, Resolution No. 57-NQ/TW (2024) on breakthroughs in science, technology, innovation, and national digital transformation, and Prime Ministerial Decision No. 749/QĐ-TTg (2020) approving the National Digital Transformation Program through 2025 with a vision toward 2030 [1, 2, 5].

Within this policy context, the construction sector occupies a position of particular significance. Spanning a broad spectrum of state management functions—from construction investment appraisal and urban planning to real estate market regulation, technical infrastructure oversight, and multi-modal transport management—the sector

generates and depends upon vast quantities of spatial, technical, and transactional data. The application of digital technology to these functions carries the potential to optimize resource allocation, improve regulatory transparency, reduce administrative burdens, and enable evidence-based decision-making at both central and local government levels.

However, the realization of this potential is critically contingent on the digital competence of the officials responsible for these functions. Current evidence suggests that the principal barrier to digital transformation in the Vietnamese construction sector is not technological availability but human adaptive capacity. The majority of officials operating across the sector's ten key management areas possess only basic information technology literacy, falling far short of the data literacy, platform operation skills, and digital governance mindset required by a functional Digital Government.

This paper addresses the gap between the policy ambition of Digital Government and the actual digital competence trajectory of construction sector officials. Drawing on documentary analysis of existing training curricula and an empirical needs assessment survey, the study identifies the structural deficiencies in current capacity-building provision, quantifies training demand across ten management areas, and proposes a comprehensive reform framework for 2026–2030. Section II describes the methodology; Section III presents results and discussion; Section IV proposes solutions and the roadmap; Section V gives conclusion.

II. RESEARCH METHODOLOGY

This study employs a mixed-method

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research design combining qualitative documentary analysis with quantitative survey-based needs assessment, organized around three complementary procedures.

The first procedure comprises a systematic documentary analysis of the strategic and normative framework governing digital transformation in the construction sector for 2020–2025, including Ministerial strategies, existing civil servant training curricula, and relevant national policy instruments [3, 4]. The analysis focuses on identifying the alignment—or misalignment—between the digital governance requirements articulated in these documents and the content of current capacity-building programs.

The second procedure consists of a structured needs assessment covering ten key state management areas identified as priority domains for digital transformation (Table I). For each area, training demand is evaluated against three dimensions: digital mindset and strategic awareness, platform operation skills (BIM, GIS, IoT, Big Data, AI), and data governance competencies, operationalized through a survey instrument administered to construction sector officials in northern and central Vietnam.

The third procedure involves a comparative gap analysis contrasting Digital Government operational requirements with the actual implementation capacity of current officials, thereby delineating the skill gaps that the proposed framework is designed to address.

TABLE I
Ten Key State Management Areas of the Construction Sector: Scope of the Training Needs Assessment

No.	Key Management Area
1	Management of construction investment activities
2	Management and development of smart cities
3	Housing, public building, and real estate market management
4	Urban and rural planning and architectural management
5	Urban technical infrastructure management
6	Building materials management
7	Road transport management
8	Rail transport management
9	Maritime and inland waterway transport management
10	Vehicle inspection management

III. RESULTS AND DISCUSSION
A. Assessment of Current Digital Training Programs and Materials

A systematic review of training programs and instructional materials currently available for construction sector officials reveals three structural deficiencies that collectively constitute

a significant barrier to Digital Government implementation.

The first deficiency is a theory–practice misalignment in program content. The majority of programs developed during 2020–2025 allocate a disproportionate share of instructional time to conceptual introductions to the Fourth Industrial Revolution and definitional explanations of digital transformation. Practical skills in data-driven governance - a prerequisite competency for Digital Government operation - are addressed only marginally, producing a workforce that can articulate the importance of digital transformation but lacks the operational capacity to make decisions on the basis of real-time data analytics.

The second deficiency is a gap in inter-agency data ecosystem skills. Survey findings indicate that existing training content provides insufficient guidance on the connection, sharing, and exploitation of data across administrative levels and between agencies. In domains such as vehicle inspection and building materials management, materials continue to focus on manual procedural workflows or single-record digitization, with no modules addressing big data analytics for risk forecasting or anomaly detection [2].

The third deficiency is the near-absence of applied modules for core digital platforms. Despite the Ministry of Construction’s articulated strategies for BIM and GIS adoption, their integration into management-level training programs remains introductory - officials are familiarized with these tools’ existence but not equipped to deploy them for quality control, planning compliance monitoring, or infrastructure performance assessment. Table II presents the core digital requirements for each management group.

TABLE II
Core Digital Knowledge and Skill Requirements by Management Area

No.	Management Area	Core Knowledge / Skill Requirements
1	Construction investment	BIM-based project management; digital permit processing; cost-estimation platforms.
2	Smart city	IoT infrastructure management; Integrated Operations Centers (IOC); spatial data analytics.
3	Real estate	Digital market surveillance; Blockchain-based property registration; big-data price monitoring.
4	Planning & architecture	GIS and remote sensing; digital map-based planning; 3D urban modeling.
5	Technical infrastructure	SCADA systems; smart water/waste management platforms; sensor-based monitoring.
6	Building materials	QR-based material traceability; digital energy-use benchmarking in production.
7	Transport (road/rail/maritime)	Intelligent Transportation Systems (ITS); real-time journey monitoring; digital inspection databases.

Table III presents aggregate survey assessment results organized around content relevance and post-training applicability.

TABLE III
Assessment of Existing Digital Transformation Training Programs for Construction Sector Officials (Scale: 1=No program exists; 2=Exists but ineffective; 3=New program development required)

No.	Evaluation Criterion	Level 1 No program exists	Level 2 Exists but ineffective	Level 3 New program needed
I	Content relevance and currency (Group I)	38%	62%	100%
1	Alignment with government & MoC digital transformation policies	–	–	–
2	Appropriateness for construction sector state management tasks	–	–	–
3	Content adjustment to reflect practical job requirements	–	–	–
II	Post-training applicability and effectiveness (Group II)	36%	64%	100%
4	Degree of improvement in digital technology application	–	–	–
5	Support for innovative working methods and productivity	–	–	–
6	Impact on internal governance and public services	–	–	–
7	Knowledge-sharing and diffusion across units post-training	–	–	–
8	Overall satisfaction with existing programs and materials	–	–	–

The results confirm that across both evaluation dimensions, 100% of respondents affirm that new or substantially reformed programs are required. Approximately 38% of content relevance areas and 36% of applicability areas currently lack any training provision, while the remaining 62% and 64%, respectively, are assessed as insufficiently effective.



Fig. 1. Assessment of existing digital training programs for construction sector officials: distribution of responses across program adequacy levels. 100% of respondents affirm the need for new program development (survey data, northern and central Vietnam).

B. Digital Competence Demand Profile Across Management Sectors

The sector-differentiated analysis reveals a highly specialized and heterogeneous pattern of digital competence demand, reflecting the distinct technological ecosystems and governance challenges of each management

area. Three thematic clusters are identified.

1) Urban Infrastructure and Planning Management (Areas 2, 4, 5)

This cluster exhibits the highest demand for spatial data governance competencies. Officials require advanced skills in integrated digital mapping (GIS) and IoT sensor data integration for smart city management. Demand extends beyond software proficiency to evidence-based spatial planning—for instance, the ability to establish flood-risk buffer zones and water-retention areas through numerical simulation, particularly urgent for mountainous provinces such as Cao Bang.

2) Construction Investment and Sector Economics (Areas 1, 3, 6)

Training demand centers on transparency and resource optimization. BIM-based digital project management and digital-ID/QR-code material traceability are the highest-priority skill requirements. In real estate market management, officials express specific need for big-data analytics to monitor market dynamics, detect speculative price anomalies, and improve social housing allocation.

3) Transport, Logistics, and Vehicle Inspection (Areas 7, 8, 9, 10)

The distinguishing characteristic is demand for real-time operational data management and AI-based anomaly detection. Vehicle inspection officials express particular interest in AI applications to detect technical deficiencies or unauthorized interference with inspection data systems, directly corroborating the skill gap identified in the documentary analysis.



Fig. 2. Digital competence demand profile across seven key management sectors: training urgency (% responding "Very Necessary") and synthesized skill gap index. Data from survey

results (Table IV) and documentary analysis.

C. Quantitative Training Needs Assessment Results

Table IV presents the full survey results covering 23 items across three categories: digital transformation awareness and knowledge, sector-specific digital skill enhancement, and training format and delivery preferences.

TABLE IV

Training Needs Survey Results: Digital Transformation Competence for Construction Sector Officials (Scale: 1=Not necessary; 2=Necessary; 3=Very necessary)

Item	Training Need	1 Not Nec.	2 Nec.	3 Very Nec.
I	Digital Transformation Awareness and Knowledge			
9	Updates on DT policies/strategies of the Government and MoC	0%	54%	46%
10	Understanding the role, benefits, and impact of DT on current work	4%	60%	36%
11	Digital competency framework for construction sector officials	2%	52%	46%
12	Paperless and process-optimized public administration	0%	55%	45%
II	Sector-Specific Digital Skill Enhancement			
13	Construction investment management	0%	42%	58%
14	Smart city management	4%	60%	36%
15	Housing / real estate market management	0%	54%	46%
16	Urban and rural planning and architecture	0%	58%	42%
17	Technical infrastructure management	4%	60%	36%
18	Building materials management	2%	53%	45%
19	Road transport management	0%	64%	36%
20	Rail transport management	2%	58%	36%
21	Maritime and inland waterway transport management	2%	52%	46%
22	Vehicle inspection management	0%	55%	45%
III	Training Format and Delivery Preferences			
24	Specialized training by field/sector	2%	62%	36%
25	Short-course, practice-intensive modules	1%	58%	41%
26	Blended (online + in-person) flexible scheduling	0%	58%	42%
27	Access to real-world case studies and DT model examples	7%	55%	38%
28	Digitized multimedia materials (video, e-book, tutorials)	2%	53%	45%
29	LMS with progress tracking and electronic certificates	3%	61%	36%
30	Communities of practice and DT experience-sharing forums	0%	58%	42%
31	Lifelong learning and self-directed technology updating	2%	60%	38%

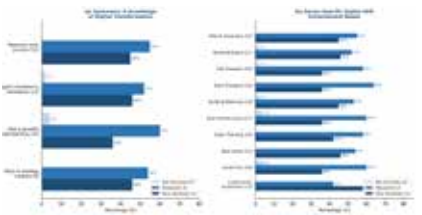


Fig. 3. Training needs survey results: (a) digital transformation awareness and knowledge needs (items 9–12); (b) sector-specific digital skill enhancement needs (items 13–22). All data from Table IV; northern and central Vietnam officials.

D. From Skill Provision to Digital Mindset Formation

The survey data converge on a finding with significant implications for curriculum design: digital transformation is a systemic change in

the modality of decision-making, not a discrete IT project. Officials across all sectors confirm that effective capacity-building cannot adopt a tool-based instructional model but must embrace problem-based, data-driven framing in which digital tools are deployed as instruments for addressing specific governance challenges.

This distinction has practical consequences for curriculum architecture. An urban planning official who acquires GIS proficiency in isolation, without concurrent data integration thinking connecting infrastructure layers (water, power, transport), will produce planning outputs that lack adaptive resilience. The reform framework proposed in Section IV addresses this inter-disciplinary data literacy gap directly.

IV. SOLUTIONS AND IMPLEMENTATION ROADMAP

On the basis of the preceding analysis, this paper proposes a five-component reform framework for enhancing digital competence among construction sector officials during 2026–2030.

A. Position-Differentiated Digital Competency Framework

Replacing the current uniform program approach with position-differentiated digital competency maps for each management area constitutes the first reform component. For leadership and management officials, the curriculum prioritizes data-driven strategic governance, executive dashboard usage for monitoring and decision-making, and critical literacy in information security and AI ethics. For specialist and operational officials, the curriculum centers on deep technical proficiency in domain-specific platforms (BIM, GIS, SCADA, ITS) and core public service execution within fully paperless digital environments.

B. Multimedia and Virtual-Practice Learning Ecosystem

The replacement of conventional print-based instructional materials with an interactive digital content ecosystem constitutes the second component. This encompasses multimedia content—video lectures, infographics, and scenario-based simulations—alongside Virtual Learning Environments (VLEs) that simulate the Ministry of Construction's actual digital management systems, including the national planning

management system and vehicle inspection database. VLEs enable officials to practice processing real-world scenarios under guided conditions before operational deployment.

C. AI-Personalized Learning Pathways

The integration of AI-powered advisory tools—specifically domain-specialized large language models—into the online training platform constitutes the third component, providing on-demand regulatory clarification (24/7 query resolution), adaptive pathway recommendations calibrated to individual skill gap profiles, and continuous content updating to maintain alignment with the evolving digital governance landscape.

D. Implementation Roadmap 2026–2030

Phase 1 (2026): complete the digital competency framework for all ten management areas and digitize 100% of core training materials. Phase 2 (2027–2028): deploy the e-learning platform with integrated virtual practice environments at scale, and establish “Sandbox” mechanisms for piloting AI tools in public administration at selected localities. Phase 3 (2029–2030): evaluate performance, standardize the Digital Government model across the sector, and transition to fully data-driven intelligent governance operations.



Fig. 4. Implementation roadmap for enhancing digital competence of construction sector officials, 2026–2030: three-phase structure with key deliverables and timeline. Phase 2 includes international cooperation with South Korean universities and GIZ for green urban planning and Net-Zero modules.

E. Financing and International Cooperation

The Academy for Construction Cadres Training is recommended to proactively secure financing from social mobilization sources and science and technology development funds for digital infrastructure investment. Strategic international cooperation with South Korean universities and the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) is recommended for the transfer of internationally benchmarked competency

programs, particularly in green urban planning and Net-Zero construction management.

V. CONCLUSION

This paper has presented a theoretically grounded and empirically validated analysis of the digital competence development needs of construction sector officials in Vietnam in the Digital Government transition context. Combining documentary analysis of existing training programs with a structured survey of officials in northern and central Vietnam, the study demonstrates that current capacity-building provision exhibits three systemic deficiencies—theory-practice misalignment, inter-agency data ecosystem literacy gaps, and the near-absence of applied platform modules—and that demand for substantive reform is both universal and sector-differentiated.

The principal empirical contributions are twofold. First, the survey provides quantitative evidence that 100% of respondents across both evaluation dimensions affirm the need for new or fundamentally reformed programs, with 36–38% identifying a complete absence of relevant provision. Second, the sector-differentiated analysis reveals that the highest urgency for “very necessary” training is concentrated in construction investment management (58%), civil aviation (47%), maritime transport (46%), and housing/real estate surveillance (46%), providing a priority ordering for resource allocation.

The reform framework proposed—comprising position-differentiated competency maps, a multimedia and virtual-practice learning ecosystem, AI-personalized learning pathways, and a phased 2026–2030 roadmap—addresses these deficiencies coherently. The central reorientation advocated is the shift from tool-based instruction to problem-based, data-driven digital governance capacity development.

Several limitations warrant acknowledgment. The survey sample is geographically restricted to northern and central Vietnam; replication in southern provinces may reveal regional variation in demand patterns. The study relies on self-reported need assessments potentially subject to social desirability bias; future

research should complement survey evidence with behavioral assessments of actual digital task performance. The proposed competency framework requires empirical validation through pilot implementation and post-program evaluation before adoption as a national standard. Future work should develop a quantitative evaluation methodology—combining competency testing, behavioral observation, and organizational performance indicators—to assess framework effectiveness under diverse implementation conditions.

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