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Analysis of Human Resource Readiness Among Government Officials for Realizing a Smart City

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Abstract

This study aims to analyze the readiness level of government human resources (civil servants) in supporting the implementation of the smart city concept, as well as to identify the facilitating and hindering factors that influence this process. The transformation toward smart governance often encounters obstacles when the rapid adoption of technology is not matched by consistent capabilities among those within the bureaucracy. A descriptive qualitative research method, incorporating a literature review, was employed. The findings indicate that the readiness of government human resources falls into the "sufficiently prepared" category, yet it has not reached an optimal level. While basic technological literacy is generally adequate, there remains a significant gap in advanced digital competencies across different generations of employees. Key challenges include cultural resistance to the shift toward digital work patterns and a shortage of personnel with specialized backgrounds in information technology. The study concludes that segmented training and development strategies, the implementation of performance-based digital talent management, and the institutionalization of knowledge management are essential to ensuring the sustainability of a smart city ecosystem.

Keywords: Smart City, Government Human Resource Readiness, Smart Governance, Modern Bureaucracy.

Introduction

The massive development of information and communication technology (ICT) in the era of globalization has driven a major transformation in the landscape of modern governance. The "smart city" concept has emerged as an innovative strategy and solution to address the increasingly complex dynamics of urban environments (Izzuddin, 2022). By integrating technology into bureaucratic systems, local governments are compelled to shift from conventional public service models toward governance that is more effective, efficient, responsive, and transparent. This implementation is no longer merely a technological trend; it has evolved into a fundamental necessity for delivering excellent public services (Sangaji & Irianto, 2025).

The successful realization of a smart city ecosystem cannot rely solely on the availability of physical technological infrastructure or the sophistication of the applications developed. The long-term sustainability and success of a smart city are heavily influenced by the pillar of "smart governance," in which the capacity and readiness of government administrators serve as the primary driving force (Ardhana, 2024). Human resources specifically government personnel are the key actors who hold full control over system operations, data management, and the direct delivery of services to the public. Consequently, significant investments in hardware and software will fail to reach their full potential if

they are not matched by the readiness of the "brainware" the human intellect and competence of those responsible for executing these systems (Mursalim, 2017).

However, empirical evidence often reveals a substantial gap between the rapid adoption of technology and the level of competency among government personnel within local bureaucracies. Many institutions become trapped in the mere formality of deploying digital applications, failing to comprehensively prepare their staff to operate these new systems (Yulianah, 2025). Consequently, digital innovations that are launched often stagnate, prove to be not user-friendly, or are even abandoned as the responsible officials choose to revert to manual work patterns. This lack of readiness highlights the need for an in-depth analysis of the extent to which digital competence, technological literacy, and psychological adaptability have been developed among bureaucratic personnel (Goeyardi et al., 2024).

The challenge of human resource readiness is further complicated by significant demographic and competency disparities within the government's workforce structure. There is a notable digital literacy gap between older, more senior officials who are often entrenched in traditional work patterns and younger officials, who tend to be more adaptable to technology (Yulianah, 2024). This gap frequently creates coordination hurdles within the organization whenever a new system is implemented. Furthermore, a shortage of personnel with formal education in information technology exacerbates technical challenges related to the maintenance and development of regional innovations (Handayani et al., 2021).

Beyond technical competence, cultural aspects and organizational behavior play a crucial role in determining the readiness of personnel for digital transformation. A bureaucratic work culture—often characterized by rigidity, hierarchy, and a preference for established routines—frequently generates resistance toward the adoption of digital-based work systems (Nazmudin & Yusup, 2026). Transitioning from traditional to electronic-based work systems requires a comprehensive paradigm shift across all levels of the workforce. Without a culture that fosters innovation and adaptability, the adoption of new technology is likely to be perceived merely as an additional workload rather than as a tool to enhance efficiency (Jafar et al., 2026).

Previous research has extensively discussed dimensions such as physical infrastructure readiness, budget availability, and the strengthening of regulatory policies in support of smart city development (Ledoh, 2019; Rambe & Abdurrahman, 2026). However, studies specifically examining the empirical reality of the readiness in terms of capacity, mentality, and behavior of the human resources (civil servants) responsible for implementation remain limited, leaving a research gap. This study aims to address this gap by focusing on the dynamics of technological adaptation, internal organizational support factors, and the cultural barriers within the workplace that hinder the progress of a modern bureaucracy.

Given this context, this study aims to conduct an in-depth analysis of the readiness level of civil servants in realizing a smart city, while also mapping the factors that either facilitate or impede this process. Theoretically, this study is expected to enrich the literature on public administration,

particularly in the areas of change management and smart governance. Practically, the findings and recommendations presented here are intended to serve as a basis for evaluation and provide strategic input for policymakers in formulating inclusive training programs and developing effective governance for the distribution of digital talent.

METHOD

This study employs a qualitative approach with a descriptive design, based on library research. The primary focus of this method is to collect, filter, and conduct an in-depth analysis of information from various relevant secondary data sources, without engaging in direct interaction or primary data collection in the field. The secondary data sources used in this study include government regulations concerning smart city roadmaps, performance reports from bureaucratic agencies, regional strategic planning documents, and both national and international scholarly journal articles that examine the readiness of human resources (civil servants/apparatus) within a smart city ecosystem (Manzilati, 2017). The inclusion criteria for the selected documents were based on the relevance of their substantive content, the credibility of the publisher, and the recency of the publication.

All collected secondary data were analyzed using qualitative content analysis and thematic analysis. The data analysis process followed an interactive model, which includes data reduction (selecting and categorizing relevant texts or documents), data display (presented through logical-descriptive narratives and theoretical comparison matrices), and the drawing of conclusions. To ensure the trustworthiness of the analysis, this study employed a triangulation technique for the secondary data sources (Satori & Komariah, 2009). This process involved comparing and contrasting the content of formal government policies with empirical data reported in existing scholarly journals, thereby yielding conclusions that are objective, critical, and theoretically grounded.

RESULT AND DISCUSSION

Analysis of the Digital Competency Readiness Level of Civil Servants

Empirical research findings indicate that the readiness level of human resources within the civil service to support the "smart governance" pillar is currently in a dynamic transitional phase. In general, bureaucratic personnel fall into the "sufficiently prepared" category; however, this readiness is somewhat superficial and has yet to fully address the substance of a comprehensive digital transformation. The observed readiness is largely confined to basic administrative and operational aspects, while strategic and innovative dimensions still require significant improvement. Consequently, the effectiveness of digital-based service systems has not yet yielded a substantial leap in bureaucratic performance.

Regarding basic technological literacy, the majority of civil servants have demonstrated adequate proficiency. Personnel at nearly all hierarchical levels possess the fundamental skills required to operate computers, utilize standard office software, and navigate routine public service applications.

This baseline technical competence has developed through daily interaction with modern administrative systems, which have gradually phased out manual work methods. This serves as a crucial foundation for government agencies as they roll out broader service digitalization initiatives.

However, a sharp decline in readiness becomes apparent when personnel are confronted with advanced digital competencies. Critical areas such as cross-sectoral database integration, macro-data analysis for decision-making (data-driven policymaking), and cybersecurity awareness remain significant weaknesses. Most employees function merely as passive users of existing application systems, lacking a deep conceptual understanding of the digital workflows and technological architecture they engage with daily.

This inability to grasp the underlying system architecture directly limits the capacity of civil servants to independently mitigate risks or resolve technical issues (troubleshooting). When disruptions occur in application systems or data synchronization fails, government personnel often face operational paralysis, becoming entirely dependent on a central technical team. This high level of dependency leads to extended service downtime, which in turn diminishes the quality of responsiveness and public satisfaction regarding the efficiency of public services—a core promise of the "smart city" concept.

This lack of digital competency is further exacerbated by a pronounced digital divide, rooted in demographic factors such as age and tenure within the organization. A sharp polarization in capacity has emerged between senior employees nearing retirement and junior staff who have recently entered the bureaucracy. These generational differences result in contrasting reactions toward the adoption of new technologies, which subsequently affects the organization's overall operational rhythm in meeting the demands for public service modernization.

Older or senior-level personnel often exhibit a slower adaptability to system changes. This group frequently experiences "technostress" and requires a significantly longer transition period simply to grasp the user interfaces of new applications. Such limitations foster a psychological tendency to delay the implementation of digital systems, with a preference for maintaining paper-based work procedures which are perceived as safer, more familiar, and less prone to technical errors.

Conversely, younger or junior staff members demonstrate high levels of efficiency, flexibility, and speed in adopting technology. As "digital natives," they are able to master new applications intuitively, without the need for intensive, traditional classroom-style training. This junior cohort holds significant potential to act as "agents of change" within the organization, given their aptitude for exploring advanced system features to accelerate the completion of complex administrative tasks.

However, this demographic polarization ultimately creates an unhealthy imbalance in the distribution of workloads within work units. Because senior staff are often perceived as lacking technological competence, the operational burden of managing "smart city" applications frequently falls entirely upon a small number of junior employees. This delegation pattern not only leads to burnout among younger staff but also hinders inclusive knowledge sharing within the bureaucratic organizational structure.

Beyond technical and demographic dimensions, the digital competence of staff is also heavily influenced by their understanding of regulations and digital ethics. The transition toward "smart governance" requires staff to grasp the legal aspects of personal data protection, public information disclosure, and the professional management of digital communications. Observations indicate that awareness of digital ethics and security remains low; for instance, poor password management practices and negligence in safeguarding the confidentiality of user data are still frequently encountered in the field.

Overall, this analysis of digital competence underscores that the readiness of the civil service workforce cannot be assessed through a single lens; rather, it is an accumulation of technical preparedness, psychological adaptability, and regulatory awareness. As long as the digital competency gap between generations remains wide and the understanding among civil servants is limited to basic operational levels, the acceleration of digital transformation within the bureaucracy will continue to stall. Local governments require structured policy interventions to raise the minimum standards for digital competency, ensuring that all levels of the civil service can move in unison to support an agile, modern governance ecosystem.

Factors Hindering the Digital Transformation of Bureaucracy

Based on a literature review, the primary obstacle to achieving human resource readiness within the bureaucracy stems from cultural factors specifically, resistance to change. Conventional, manual, hierarchical, and paper-based work patterns have been deeply entrenched for decades, serving as a "comfort zone" for many government employees. As work systems migrate toward a digital ecosystem that demands transparency, speed, and individual accountability, a psychological reluctance to learn new procedures emerges. The fear of losing the authority or the ease associated with old work patterns leads to a passive rejection of the paradigm shift toward "smart governance," manifested through the delayed adoption of new systems.

This cultural barrier also manifests in an organizational culture that tends to be rigid and unsupportive of innovation. Highly formalistic bureaucratic structures often penalize technical errors strictly, leading civil servants to feel safer avoiding anything outside their established routines. New technology is frequently perceived as an "additional workload" rather than as a tool designed to simplify tasks. Without the internalization of agile and adaptive work values, even the most sophisticated applications will fail to produce tangible changes in work behavior at the operational level.

Beyond these cultural hurdles, a critical structural constraint is the limited number of personnel with formal education or specialized expertise in Information and Communication Technology (ICT). At the regional level, the workforce remains largely dominated by individuals with backgrounds in the social sciences and public administration. The scarcity of specialized roles for technology experts—such as data analysts, system administrators, and cybersecurity specialists leaves government agencies struggling when tasked with managing, integrating, and developing complex application systems in-house.

This limited supply of technical expertise often forces organizations to assign personnel to roles for which they lack the necessary competencies a mismatch. Many work units are compelled to appoint staff with non-technical backgrounds as the primary managers or operators of databases and public service applications. Such "stopgap" staffing decisions negatively impact the quality of digital system management. These individuals often lack the theoretical knowledge or practical capacity required for routine system maintenance, leading to suboptimal technology utilization and an increased risk of malfunctions.

Furthermore, these structural barriers are exacerbated by incentive and reward systems that fail to account for digital performance achievements. Staff members who work diligently to explore new technologies and drive service efficiency through digital means receive the same compensation and recognition as those who persist with manual, traditional methods. This lack of differentiation in rewards diminishes the intrinsic motivation for employees to independently improve their digital literacy. Consequently, the impetus for digital transformation arises only in response to direct, coercive mandates from leadership, rather than from a genuine commitment to professional excellence.

From a managerial perspective, current education and training programs are largely ineffective in addressing the root causes of human resource unpreparedness. Training initiatives within government agencies tend to be overly formal, classroom-based, large-scale, and purely theoretical. Such programs frequently overlook the need for post-training mentoring—a critical form of support that employees require when encountering real-world technical challenges in their daily work. As a result, the knowledge gained during training sessions simply evaporates, never being implemented into daily tasks.

The final hindering factor relates to weak knowledge management within the organization. When a staff member with a high level of digital literacy is transferred or reassigned to another unit, their technical expertise regarding the management of application systems goes with them without any structured knowledge transfer to their successor. The absence of documented Standard Operating Procedures (SOPs) for digital operations at this micro-level forces the affected unit to restart the learning process from scratch, which ultimately undermines the consistency and sustainability of the smart city program.

Supporting Factors and Strategies for Capacity Strengthening

Amidst various cultural and structural obstacles, this study identifies strong leadership commitment as a primary supporting factor for this ecosystem. Within the bureaucracy, the role of a leader extends beyond mere supervision; leaders act as facilitators and agents of change, defining the direction of digitalization policy. This commitment manifests in the allocation of specific budgets for hardware upgrades, the development of integrated application systems, and the provision of technology-based training facilities. Progressive leadership can mitigate internal resistance and provide the political impetus necessary for the entire organization to successfully pursue a "smart city" agenda.

In addition to leadership, the presence of internal regulations characterized by a "coercive-constructive" nature serves as a catalyst for the digital adaptation of civil servants. Local government

policies that mandate the digital recording of daily work activities, performance reporting, and personnel administration effectively compel staff to step out of their comfort zones. These rules create a functional reliance on technology; those who refuse to adopt digital systems face administrative consequences, such as the withholding of performance-based allowances. This structured, mandatory mechanism has proven effective in raising the minimum standard of digital literacy across all levels of the bureaucracy.

Another supporting factor is the emergence of modern, integrated learning infrastructure within the government, such as the concept of a "corporate university" at the local level. Moving away from rigid, conventional training approaches, this framework offers more flexible, self-directed learning methods via e-learning platforms. Civil servants can access training materials, digital literacy modules, and tutorials on how to use public service applications at any time, without disrupting their operational work hours. This flexibility in access provides a positive stimulus for civil servants with high intrinsic motivation to independently enhance their digital competencies.

To optimize the potential of these supporting factors, the strategy for strengthening human resource capacity must shift from a mass-based approach to one that is more inclusive and segmented. Local governments can no longer rely on a "one-size-fits-all" model for digital training across all employee levels. Training and development strategies should be designed in a tiered manner covering basic, intermediate, and advanced digital competency profiles tailored to the specific, real-world needs of each work unit. For senior staff, training should focus on user-friendly interface adaptation and technical assistance, while for junior staff, the emphasis should be on strengthening macro-data analysis capabilities.

Another equally crucial strategy is the implementation of a comprehensive, digital-based talent management policy. Processes such as job rotations, transfers, and promotions should be integrated with each employee’s digital track record. Civil servants who demonstrate significant innovation in simplifying public services through the optimization of technology should be granted priority for career advancement (a "fast-track" path). Such recognition, based on innovative performance, will foster a healthy competitive climate within the organization while encouraging other staff to continuously improve their own technological capabilities.

Furthermore, local governments need to restructure their recruitment patterns for new personnel by allocating a larger share of positions to talent in the field of Information and Communication Technology (ICT). Increasing the number of these specialized experts is essential to ending the issue of job-role mismatches. The addition of new staff with formal educational backgrounds in areas such as computer architecture, cybersecurity, and data analysis will inject fresh energy into work units, while also serving as internal mentors for non-technical colleagues.

Finally, capacity building must be accompanied by the institutionalization of knowledge management to ensure the sustainability of the smart city system. Every digital innovation and operational procedure for service applications must be documented in the form of standardized and easily accessible Standard Operating Procedures for Digital Operations (SOP-DO). Furthermore, a

cross-departmental "community of practice" should be established, serving as a platform for ICT managers to share solutions for the technical challenges they encounter. Through this institutionalization of knowledge, the sustainability of the bureaucracy's digital transformation will not be compromised or disrupted by the reassignment of officials or changes in field personnel.

CONCLUSION

This study concludes that the readiness of human resources within the civil service to implement the "smart city" concept is moderate, yet not functioning optimally. While basic technological literacy is widespread among most employees, readiness in areas such as advanced digital competencies, macro-data analysis, and the resolution of technical system issues remains low. This situation is exacerbated by a digital capability gap across different generations of employees, which leads to an uneven distribution of operational workloads. Cultural barriers—manifesting as psychological resistance to the shift toward digital work patterns—along with a limited number of personnel with backgrounds in information technology, represent critical structural obstacles. Nevertheless, progressive leadership commitment and the implementation of electronic-based reporting regulations have proven to be key supporting factors that drive this transition toward a modern bureaucracy.

As a tactical recommendation, local governments should restructure their digital competency training programs, designing them in a segmented and tiered manner based on the actual needs of individual employees, rather than relying on a one-size-fits-all approach. Local governments should also implement a digital-based talent management policy that links career advancement with achievements in technological innovation, while simultaneously increasing the recruitment of new personnel with expertise in computer science to address the shortage of specialists. Finally, institutionalizing knowledge management—through the development of standardized digital operational guidelines and the establishment of cross-unit communities of practice—is essential to ensure the consistency, sustainability, and long-term success of a "smart governance" ecosystem.

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