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The Digitalization of Duty: Interpreting the New Social Labor of Civil Servants in Indonesia's Smart City Bureaucracy

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ABSTRACT

The digital transformation of global cities toward the Smart City paradigm fundamentally reconfigures the social contract and cultural practices of public governance, heavily relying on Civil Servants (ASN), to actively forge a new digital-social ecosystem. This study proposes and explores Digital Organizational Citizenship Behavior (Digital OCB) as a new concept lens, integrating traditional OCB with the dynamics of online participation to interpret the voluntary, non-mandated digital labor of civil servants within the bureaucratic structure. specifically designed for public organizations that are becoming more digital. By analyzing data from 397 civil servants in five smart cities in Central Java, Indonesia, the study shows that digital OCB has four parts: digital altruism, digital civic virtue, digital conscientiousness, and digital voluntary engagement. The results, which explain 50.7% of the overall differences, strongly confirm that Digital OCB is a valid concept and expand the use of Social Exchange Theory (SET) and Perceived Organizational Support (POS) to the digital world. The implications are significant for understanding how to organically cultivate a culture of voluntary digital citizenship among civil servants, which. Is crucial for fostering social legitimacy and a sustainable culture of democratic innovation beyond more technical efficiency. This study addresses a gap in the literature by providing a solid theoretical and methodological foundation for future research on digital voluntary behavior in the public sector.

Keywords: Digital OCB, Smart city, Online participation, Exploratory factor analysis, Civil servant.

INTRODUCTION

Globalization and technological disruption have placed cities worldwide at the forefront of digital transformation, driving the Smart City vision as the future paradigm of urban development. The Smart City concept, which integrates information and communication technology to enhance operational efficiency, public service quality, and citizen well-being, has become a strategic priority in many countries (Rizi & Seno, 2022). However, Smart City implementation involves more than installing technological infrastructure. The success of a smart city fundamentally depends on the readiness and capacity of its human resources, especially civil servants who operate the machinery of governance (Denkowska et al., 2020; Greutter-Gregus & Greutter, 2024). Civil servants must demonstrate adaptability, competence, and proactiveness in utilizing digital technology to mobilize a dynamic and complex smart city ecosystem. Without capable human capital, even advanced technological investments will struggle to reach their full potential (Kociuba et al., 2023).

In Indonesia, the national initiative 'Gerakan Menuju 100 Smart City' reflects the government's commitment to digital transformation. This program aims to accelerate digital development in cities and districts to improve bureaucratic efficiency, public service quality, and citizen participation. However, on-the-ground implementation has revealed major challenges, particularly at the level of civil servants (ASN), who serve as key actors in Smart

City governance (Sivitas, 2020). Although the government has invested in digital infrastructure and technical training through the Civil Servant Information System (SI ASN), empirical data and preliminary observations show that many ASNs have not adopted technology in ways that align with behavioral and cultural changes necessary to sustain a digital ecosystem. This gap underscores an urgent need both scientific and practical to understand the dynamics of voluntary digital behavior among ASNs, which is essential for Smart City transformation.

Existing literature on technology adoption, such as the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT) (Almogren & Aljammaz, 2022; Davis & Granić, 2024; Venkatesh, 2022), is often criticzed for its technocratic reductionism, argely emphasizes functional dimensions and individual decisions based on perceived usefulness and ease of use (Abbad, 2021). Thereby overlooking the deeper cultural negotiation involved in digital work. While these models have contributed significantly, they remain analytically inadequate for capturing the voluntary, collective, and prosocial forms of digital participation-behaviors that represent a critical, yet often invisible, social shift in modern organizational dynamics. Critically, these behaviors emerge not from mere utility-based calculations but from organizational commitment, social responsibility, collective norm, and deeper participatory values (Abbad, 2021), effectively re-embedding digital work within a complex web of social relationship and ethics.

Meanwhile, the concept of Organizational Citizenship Behavior (OCB) has long served as a key theoretical framework for explaining voluntary behavior beyond formal job roles in traditional workplaces (Abbasi et al., 2025; Organ, 1988). However, conventional OCB does not sufficiently account for behaviors emerging in digital spaces (Digital OCB). Conversely, studies on online participatory culture (Jenkins, 2014) describe active, voluntary involvement, yet they are typically confined to informal, non-hierarchical digital communities, thus presenting a conceptual lacuna when applied to the procedural, hierarchical culture of public bureaucracy. This theoretical gap raises a critical question: can online participatory values that succeed in informal communities be effectively adopted in hierarchical, procedural environments such as the ASN bureaucracy within smart cities? Fundamental differences in organizational structure, modes of interaction, and individual motivation demand a more comprehensive conceptual framework.

To address this theoretical void and practical need, this study proposes and explores Digital Organizational Citizenship Behavior (Digital OCB). This concept integrates traditional OCB with online participatory culture to explain voluntary behavior in formal digital organizational settings, particularly within the public sector. Digital OCB accounts not only for technical adoption but also for organizational attachment, professionalism, and formal relationships within bureaucracy dimensions, often overlooked in pure technology adoption models and studies of informal online participation. The conceptualization of Digital OCB draws heavily on Social Exchange Theory (SET) (Bui & Jeng, 2022), which views voluntary behavior as reciprocal to perceived organizational trust and support. In digital contexts, the concept includes infrastructure support, inclusive policies, and a collaborative online environment.

Digital OCB functions as a cultural strategy to strengthen the internal digital readiness of civil servants and directly support the realization of Smart City goals. It plays a key role in accelerating technology adoption, promoting digital work culture, and enhancing collaboration within bureaucratic environments that foster Smart City ecosystems (Yuniarti et al., 2024). Digital OCB has shown relevance in increasing civil servant participation in sharing digital information, mentoring colleagues in technology use, and creating inclusive collaborative cultures (Yulianto et al., 2024). These behaviors extend beyond technical skills, encompassing proactivity, initiative, and a spirit of collaboration across digital platforms. Digital OCB encourages initiatives such as intergenerational collaboration where younger civil servants guide their seniors and gender-based digital skill development programs. It also supports a digital knowledge-sharing culture through informal mentoring and collaborative discussion forums.

Thus, thoroughly investigating Digital OCB and its impact on civil servant performance becomes essential to generating evidence-based solutions for improving digital transformation in the public sector. This study offers substantial novelty by introducing and developing Digital OCB as a transformative behavioral and cultural mechanism that goes beyond technical solutions. It focuses on shaping values and behaviors that intrinsically drive digital adaptation and performance within smart city bureaucracies. The study provides crucial empirical evidence on how Digital OCB can serve as a driving force for achieving bureaucratic efficiency and effectiveness in the digital era, complementing efforts to develop infrastructure and enhance technical competence, both of which are vital for Smart City success in Indonesia.

LITERATURE REVIEW

Smart City Concept and Human Resource Readiness

The cultural and social interpretation of the smart city has evolved beyond its initial portrayal as a city that merely adopts advanced technology, becoming a site for the negotiation of new public values. The concept of the smart city has evolved beyond its initial portrayal as a city that merely adopts advanced technology. In this expanded view, the effectiveness of smart city initiatives depends not only on technological infrastructure but also on the reconfigured social contract and cultural practices of public governance, particularly how civil servants internalize and perform their roles within this new digital-social ecosystem. While the Technology Acceptance Model (TAM) posits that perceived usefulness and perceived usefulness and ease of use determine technology adoption (Davis and Granić 2024a). this perspective often faces criticism for its "technocratic reductionism", overlooking the deeper cultural negotiation and prosocial values that drive voluntary digital work. In the context of smart city governance, TAM explains how civil servants' acceptance of digital tools depends on their belief that these tools enhance work efficiency and are easy to operate. When civil servants perceive digital systems as useful and user-friendly, they are more likely to engage in digital organizational citizenship behavior, such as voluntarily sharing online resources or assisting colleagues through digital platforms. By applying TAM, researchers can examine the relationship between technology acceptance and extra-role behaviors that support organizational effectiveness, thereby highlighting the human dimension in realizing the goals of a smart city.

Contemporary literature defines the smart city as a complex ecosystem that leverages information and communication technology (ICT), but its socio-cultural success depends heavily on fostering new forms of citizen and civil servant participation and democratic innovation, moving the focus from mere technical efficiency to social legitimacy. This modern approach recognizes technology as a facilitator, not the core. A city becomes "smart" based on how it leverages technology to address urban challenges and generate value (Samarakkody et al., 2022). Many Smart City frameworks identify multidimensional pillars, such as the popular six pillars (Smart Governance, Smart Economy, Smart Living, Smart Environment, Smart People, and Smart Branding) that reflect the interconnectedness of sectors in achieving Smart City goals (Penmetsa & Bruque Camara, 2022). These frameworks signal a paradigm shift from technology-centered models to holistic approaches that account for social, economic, and environmental dimensions.

To realize this comprehensive Smart City vision, proactiveness human resources (HR) especially civil servants, is central, as they must embody the necessary behavioral and cultural changes to sustain the digital ecosystem. HR readiness extends beyond mere availability; it involves critical dimensions such as digital competence, adaptability to change, and an innovative mindset (Tanantong et al., 2024). Civil servants (ASN), as the primary actors responsible for policy implementation and Smart City service delivery, must demonstrate the capacity to adopt and utilize technology effectively. This shift demands a concept of digital literacy that transcends basic skills to include social digital competence, the ability tu utilize technology not just to operate devices but also to foster collaboration, co-create solutions, and embody digital ethics within the bureaucratic context. In addition, Smart City readiness requires intersectoral collaboration skills, data-driven analytical thinking, and the ability to innovate in dynamic environments (Guenduez & Mergel, 2022). Without these capabilities, even large-scale investments in digital infrastructure will fall short, since the innovation and efficiency promised by Smart City initiatives depend heavily on human capacity to manage and use technology intelligently (Tanantong et al., 2024).

Therefore, continuously developing the competence and capacity of civil servants through digital literacy training and other relevant skill enhancement programs constitutes a foundational investment in the journey toward a truly smart city.

Organizational Citizenship Behavior (OCB) and Social Exchange Theory Foundation (SET)

Organizational Citizenship behaviour (OCB) has long been the primary framework for explaining discretionary, extra-role actions in traditional workplaces (Bogler and Somech 2023). crucially, however, conventional OCB fails to capture theorize the unique behavioural complexities emerging in purely digital and virtual organizational spaces (Alshaabani et al. 2021). OCB comprises several dimensions, including altruism (helping colleagues), conscientiousness (exceeding role requirements), sportsmanship (maintaining a positive attitude), courtesy (polite behaviour), and civic virtue (responsible participation in organizational life). Numerous studies have confirmed OCB's positive effects on individual, team, and organizational performance across sectors (Daniel, 2024).

Social Exchange Theory (SET), the primary framework for OCB, views voluntary behaviour as reciprocal to perceived organizational fairness and support. (Al Hourani and Al-Sarayrah 2024). This study seeks to extend SET and perceived organizational support (POS) by applying its principles to the digital realm, framing Digital OCB as a reciprocal social exchange rooted in POS (e.g., Infrastructure, flexible policies) (Blau 2017). This theory posits that individuals voluntarily engage in positive behaviours as a reciprocal response to the fairness, support, and trust they receive from the organization (Bui and Jeng 2022). When employees perceive fair treatment and strong organizational support, they feel compelled to reciprocate through positive contributions (Xu et al. 2023). SET

effectively predicts employee commitment, motivation, and retention by emphasizing positive exchange relationships characterized by trust and fair rewards (Kilroy et al. 2023; Meira and Hancer 2021) (Kilroy et al., 2023; Meira & Hancer, 2021). Trust, shared values, and reputation are the key factors shaping SET, as they promote ongoing social interaction, reduce uncertainty, and foster long-term commitment (Chen and Sriphon 2022).

The evolution of SET has given rise to more complex, relational theories such as Leader–Member Exchange (LMX), Perceived Organizational Support (POS), and Social Capital (Chen and Sriphon 2022). Grounded in SET, POS creates a sense of obligation to reciprocate (Trenerry et al. 2021). In the digital context, this concept must be redefined to capture employees perception of digital support (e.g., high-quality digital training, formal recognition of digital contributions) as the foundation for voluntary digital giving back (Bahadır et al. 2024). High POS encourages a sense of safety and appreciation, which in turn strengthens commitment and promotes OCB, even in digital settings (Wu et al. 2023). Meanwhile, social capital refers to the value embedded in networks of social relationships formed through mutually beneficial exchanges (Chetty et al. 2022). These developments illustrate how SET principles have evolved to accommodate the subtle and complex nature of modern organizational relationships, framing OCB as a voluntary psychological exchange rooted in social bonds (Amina et al. 2021).

Online Participation Culture and Digital Literacy Role

Online participation culture, rooted in Jenkins' (2006) theory, emphasizes individuals' active, voluntary engagement in creating and sharing digital content (Handayani et al. 2024). However, this framework typically focuses on informal, non-hierarchical digital communities, presenting a critical conceptual gap when attempting to explain voluntary behaviour within the procedural and hierarchal culture of public bureaucracy. Based on Jenkins' (2006) Participatory Culture theory, online participation involves active engagement in creating, sharing, and interacting with digital content, fostered by minimal barriers to expression and strong community support. In the context of smart city governance, this culture of participation enables civil servants to consume digital information and collaboratively produce and exchange knowledge through official platforms. Such an environment promotes transparency, strengthens citizen–government interaction, and nurtures a shared sense of responsibility for urban development. As participation norms evolve in digital spaces, they shape how public officials engage with stakeholders and co-create solutions in the smart city ecosystem.

This cultural frame highlights collaboration and knowledge sharing. The central theoretical challenge is understanding how these values collective creativity and active participation, successful in informal spaces, are negotiated and institutionalized within a formal, hierarchical system like the ASN bureaucracy. In organizational settings, online participation culture reflects a shift from one-way communication models to interactive frameworks that encourage members' involvement in decision-making, innovation, and the collective dissemination of organizational values (Hall et al. 2021).

In public service organizations, online participation culture plays a critical role in strengthening both employee and public engagement in transparent, responsive, and participatory service delivery processes (Mannell and Smith 2022). Through online participation, employees can actively share ideas, experiences, and solutions to improve service performance, while the public can act as strategic partners (Saraf et al. 2022). Digital literacy acts not just as a basic skill but as a cultural catalyst that enables civil servants to participate, innovate, and lead digital initiatives voluntarily, effectively turning digital potential into empowering organizational behavior. Without sufficient digital competencies, employees will face barriers in accessing participation platforms, engaging in online interactions, and contributing ideas or solutions digitally (Cetindamar Kozanoglu and Abedin 2021).As a key enabler, digital literacy connects the potential of online participation culture with tangible behavioral outcomes (Haider and Sundin 2022).

Digital Organizational Citizenship Behavior (Digital OCB): a New Conceptualization

As modern organizations increasingly integrate digital systems, scholars and practitioners have reached a critical point in understanding employees' voluntary behavior, which now demands more sophisticated conceptualization. The concept of Digital Organizational Citizenship is rooted from (Yulianto et al. 2024). Digital OCB is proposed as a new conceptual lens to interpret the voluntary, non-mandated digital labor of civil servants, going beyond technical adaption to capture the deeper socio-cultural shif in bureaucratic roles. It encompasses behaviors such as sharing digital resources, offering assistance through online tools, and maintaining a constructive virtual presence. Digital OCB emerges as a distinct socio-cultural construct that fundamentally captures the re-embedding of digital work within complex web of social relationship and participatory ethics, thus extending OCB to account for extra-role contributions in digitally mediated work.

Employees engage in this voluntary behavior by utilizing digital tools applications, collaborative platforms, internal networks, and information systems to enhance colleagues' well-being, streamline operations, and improve overall organizational effectiveness, beyond formal job expectations (Caridà et al., 2022).

The qualitative distinctiveness of digital OCB is crucial, it operates in a medium (e.g., cloud drives, online forums) characterized by persistent digital traces and network effects, where altruism is performed not through physical cues but through the proactive sharing of digital resources and knowledge, offering new opportunities for cultural contribution (Campbell, 2025). For example, employees who proactively share important documents in shared cloud drives, provide constructive feedback in online forums, or voluntarily manage internal digital communication channels demonstrate digital OCB in qualitatively distinct ways from physical office-based altruism. These unique digital features offer new opportunities for contribution while also introducing challenges related to visibility, attribution, and recognition.

This deeper conceptualization of Digital OCB extends Social Exchange Theory (SET) and Perceived Organizational Support (POS) by incorporating a digital dimension into reciprocal relationships. In the context of Digital OCB, employees perceive organizational support through reliable ICT infrastructure, high-quality digital training, flexible online work policies, and formal recognition of digital contributions. These factors trigger a reciprocal cycle, where civil servants (ASN) who feel supported in their digital journey become more motivated to "give back" through digital OCB.

Moreover, online participation culture (Jenkins & Ito, 2015) shapes how ASN interacts and influences collective norms around voluntary digital sharing and collaboration. It creates an environment where digital OCB becomes an expected and valued element of professional identity. Digital literacy (Gilster & Glister, 1997; Saputra & Al Siddiq, 2020) no longer serves merely as a basic skill set; it acts as a catalyst that enables ASN to participate, innovate, and lead digital initiatives voluntarily, turning digital potential into empowering organizational behavior.

Digital OCB also differs fundamentally from related concepts such as "technology adoption" or "digital skills." Technology adoption concerns acceptance and use; digital OCB involves the intentional and proactive use of those tools to exceed job roles. Digital skills indicate capability; digital OCB reflects the willingness and action to apply those capabilities for collective benefit. In bureaucracies transitioning toward Smart City models, such behavior becomes essential. Digital OCB functions as a key cultural strategy to organically cultivate a culture of voluntary digital citizenship and accelerate the collective intelligence of the bureaucracy, thereby fostering the social legitimacy and sustainable culture of democratic innovation necessary for a true smart city (Andrade and Neves 2022). These behaviors lay the foundation for cultivating digital "collective intelligence," enabling governments to respond to public needs with greater agility and effectiveness, shaping public administration that is not only digitally efficient but also adaptive and service-oriented through voluntary engagement.

RESEARCH METHODOLOGY

This study employed an exploratory analysis to navigate the complex, often unarticulated behavioral patterns of digital civil servants, aiming not merely to test but to uncover the underlying normative structure the governs their voluntary digital contributions. This approach proves particularly valuable in fields where the social context of digital labor remains poorly understood, enabling researchers to empirically map the boundaries of this emerging organizational culture (Haile, 2023; Makri & Neely, 2021).

The sample consisted of 397 civil servants (ASN) employed in five smart cities in Central Java Province, Indonesia. The researchers employed proportional random sampling to ensure that the resultant empirical structure represents a sociologically balanced cross-section of the local government's emerging digital workforce. Data collection in this study was carried out online using a Google Form-based questionnaire, which consisted of 24 statements. Each item used a five-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree) (Jebb et al. 2021). The questionnaire items were carefully adapted from on traditional OCB and online participation culture to sensitize the instrument to the specific cultural and bureaucratic context of Indonesia Civil servant (Podsakoff et al. 2014). The distribution of questionnaires is carried out through various official communication channels, ASN internal WhatsApp groups in each city government and Telegram Groups and institutional mailing lists/emails managed by the personnel department. Before the dissemination process was carried out, the researcher had obtained official permission from the relevant municipal government and appointed a local contact liaison to assist in the monitoring process and mobilization of respondent participation. Each prospective respondent receives a full explanation of the purpose of the research, the guarantee of data confidentiality, and the voluntary nature of their participation. All questionnaires are filled out anonymously, to maintain independence and honesty in responses.

The researchers conducted all analyses using JASP statistical software version 0.19.0. They collected the data online. Ethical approval was obtained from the relevant institutional board, and all participants gave informed consent after receiving full information about the study's purpose and data confidentiality (Akcam et al., 2019). Participation was voluntary and anonymous. Data collection took place between September and April 2025.

RESULT AND DISCUSSION

Demography Respondent

A total of 397 State Civil Apparatus (ASN) from five smart cities in Central Java Province became respondents in this study. Their demographic characteristics are classified by gender, education level, length of employment, and urban origin.

Based on gender, most respondents were women, namely 210 people (52.9%), while male respondents amounted to 187 people (47.1%). In terms of education, most of the respondents have a bachelor's education background (S1), with a total of 238 respondents (59.9%). Meanwhile, the most working period is in the range of 5 to 10 years, which is as many as 153 respondents (38.5%), showing the dominance of the ASN group who are in the middle phase of their bureaucratic career.

When viewed based on regional origin, the largest number of respondents came from the city of Semarang, which is also the capital of Central Java Province. A total of 98 ASN (24.7%) who participated came from this city, indicating a strong representation of the provincial government center in the context of Smart City development. More complete information can be seen in Table 1 showing the demographics of the respondents.

Table 1. Demographic Characteristics of Respondents.

Variable	Category	Frequency (n)	Percentage (%)
Gender	Woman	210	52,9%
	Man	187	47,1%
Education	Diploma (D3)	25	6,3%
	Bachelor (S1)	238	59,9%
	Master (S2)	134	33,7%
Length of Service	< 5 years	98	24,7%
	5–10 years	153	38,5%
	> 10 years	146	36,8%
Origin of the City	Semarang	98	24,7%
	Surakarta	84	21,2%
	Salatiga	73	18,4%
	Magelang	69	17,4%
	Pekalongan	73	18,4%

Kaiser Meyer Olkin (KMO) Test

This section presents the empirical findings from the exploratory factor analysis (EFA) on the dimensions of Digital OCB among civil servants (ASN). It begins with the results of data suitability tests for factor analysis, followed by the dimensional structure identified through EFA. Before conducting EFA, the researchers performed the Kaiser-Meyer-Olkin (KMO) test and Bartlett's Test of Sphericity to assess data adequacy. Table 2 presents the results of these preliminary tests.

Table 2. Kaiser Meyer Olkin Test.

ITEM	MSA	ITEM	MSA	ITEM	MSA
Item 1	0.764	Item 9	0.883	Item 17	0.902
Item 2	0.767	Item 10	0.869	Item 18	0.827
Item 3	0.785	Item 11	0.827	Item 19	0.826
Item 4	0.881	Item 12	0.744	Item 20	0.755
Item 5	0.866	Item 13	0.869	Item 21	0.909
Item 6	0.771	Item 14	0.845	Item 22	0.895
Item 7	0.847	Item 15	0.868	Item 23	0.906
Item 8	0.894	Item 16	0.832	Item 24	0.904
KMO Overall		0.853		Extremely excelent (Kaiser,1974)	
Lowest MSA Item (Item 12)		0.744		Reliable	
Bartlett's Test of Sphericity	Chi—square	5100.523		Reliable	
	Df	276			
p-value		<0.001		Significant correlation among variables (Bartlett, 1954)	

Table 2 confirms that the data were highly suitable for factor analysis. The Kaiser-Meyer-Olkin (KMO) value of 0.853 provided a robust measure of sampling Adequacy (MSA) values, while the highly significant Bartlett's Test

of Sphericity ($p<0.001$) confirmed the interconnectedness of the digital behaviours, empirically supporting the notion that they function as a unified, emerging social construct.

Exploratory Factor Analysis

The researchers conducted an exploratory factor analysis (EFA) using principal component analysis (PCA) for extraction and Promax for rotation. The exploratory factor analysis successfully decomposed the observed digital behavior into four distinct latent dimensions, providing the structural basis for the new behavioral framework. These dimensions collectively account for 50.7% of the total variance, demonstrating a substantial empirical fit. Table 3 presents the detailed factor structure and item loadings.

Tabel 3. The Exploratory Factor Analysis (EFA) of Digital Organizational Citizenship Behavior Dimension.

Item	Brief statement of the items	Factor 1	Factor 2	Factor 3	Factor 4	Uniqueness
ITEM 5	Digital Positive Attitude	0.899				0.185
ITEM 4	Initiating Digital Efficiency	0.856				0.230
ITEM 17	Sharing System Update	0.800				0.347
ITEM 7	Obeying Digital Ethics	0.795				0.255
ITEM 13	Sharing Digital Information	0.732				0.398
ITEM 8	Communicating Digital Ethics		0.771			0.363
ITEM 11	Responding to E-Gov Issue		0.712			0.304
ITEM 10	Collaborating to Digital Project		0.667			0.553
ITEM 14	Advocating Digital Security		0.644			0.465
ITEM 15	Discussing Online Smart City		0.621			0.362
ITEM 24	Adapting to latest digital policy			0.688		0.433
ITEM 6	Actively participating in digital transformation forum			0.676		0.507
ITEM 22	Contributing idea through digital media			0.632		0.461
ITEM 23	Having technology-based interpersonal relation			0.572		0.565
ITEM 16	Supporting problem-solving based digital innovation			0.546		0.553
ITEM 9	Using digital tool for performance efficiency			0.480		0.612
ITEM 12	Having initiation and creativity in digital technology exploration			0.424		0.781
ITEM 3	Volunteering technology implementation				0.659	0.516
ITEM 1	Training and empowering civil servants digitally				0.595	0.605
ITEM 18	Committing to digital performance responsibility				0.560	0.566
ITEM 21	Initiating to share digital knowledge				0.495	0.449
ITEM 20	Actively participating in digital organization forum				0.463	0.809
ITEM 2	Participating in civil servant-digital community				0.453	0.709

ITEM 19	Producing and distributing educative digital content				0.439	0.794
Remarks	Eigenvalue	7.711	2.728	1.888	1.707	
Percentage of Explained Variance		15.6%	11.9%	11.6%	11.6%	
Comulative Variance Total		15.6%	27.5%	39.1%	50.7%	

Labelling The Dimensions

The EFA results, supported by a high KMO value of 0.853 and a significant Bartlett's Test ($p < 0.001$), confirmed data suitability for factor analysis and validated the construct of Digital OCB as a multidimensional phenomenon. The empirical identification of the four latent dimensions-Digital Altruism, Digital Civic Virtue, Digital Conscientiousness, and Digital Voluntary Engagement serves as the quantitative evidence for a profound socio-cultural shift in bureaucratic expectations, extending Organ's (1988) classical OCB framework into the digital domain. These findings align with the argument that voluntary work behavior now extends beyond physical interaction, responding to increasingly digitized organizational environments (Abbasi et al., 2025).

Digital Altruism (Faktor 1) is empirically defined by item loadings emphasizing peer-to-peer technical solidarity, such as proactively assisting with e-government updates (Item 7) and voluntarily sharing documents (Item 17). This highlights the normalization of voluntary digital mentoring as a social exchange mechanism within the public sector. This pattern aligns with Social Exchange Theory (SET), where civil servants who perceive organizational support (Perceived Organizational Support/POS) respond with prosocial behavior that exceeds formal duties (Blau, 1964; Eisenberger et al., 2001). In digital contexts, this altruism manifests as technical assistance or knowledge-sharing that supports collective adaptation to innovation (Michalová & Maršíková, 2023). This dimension expands traditional OCB's altruism concept (Organ, 1988), indicating that helping behavior now extends into virtual environments via digital platforms (Dong et al., 2023), which is essential for successful e-governance implementation.

Digital civic virtue (factor 2) captures the empirical manifestations of responsible digital citizenship. It is defined by items that reflect engagement in the broader digital ecosystem, suggesting that civil servants are actively adopting digital ethical norms. As part of their organizational identity. Items such as "ensuring effective and respectful communication when resolving technology-related conflicts" (Item 8) and "keeping up with updates on e-government policies and technologies" (Item 10) serve as strong indicators. This dimension also includes promoting safe and responsible technology use (Item 14) and engaging with smart governance issues on social media (Item 15). It emphasizes how digital ethics and awareness of technology's broader impacts have become integral to OCB (Asimakopoulos et al., 2025). This suggests that civil servants are not merely passive users of technology but also active agents who foster a responsible and constructive digital culture in the workplace, consistent with the concept of online participation culture (Jenkins, 2009).

Digital conscientiousness (factor 3) delineates the individual internalized drive toward digital self-improvement and performance optimization. The high loading of items related to proactive policy acceptance (Item 6) and innovation digital tool use (Item 9) demonstrates a cultural valuing of digital adaptability beyond basic job requirements. Relevant items include "accepting new policies and procedures related to digitalization with a positive attitude and readiness to adapt" (Item 6), "actively participating in smart governance development meetings or discussions" (Item 9), and "consistently using digital tools to optimize tasks" (Item 23). This dimension highlights proactive efforts to apply technology in ways that enhance service quality and efficiency (Item 24). Digital conscientiousness goes beyond basic compliance; it involves deliberate and innovative technology use aimed at achieving better outcomes. It affirms the relevance of digital literacy (Sari et al., 2024) and adaptive digital competence (Li et al., 2022) in shaping OCB for modern workplaces.

Digital Voluntary Engagement (Factor 4) constitutes the institutionalized collective effort toward digital transformation. Defined by item such as peer training (Item 1) and active forum participation (Item 19), this dimension provides empirical evidence for the emergence of a self-sustaining participatory culture within the bureaucracy. Examples include "voluntarily helping colleagues understand new e-government systems" (Item 1), "willingly providing training on information transparency technologies" (Item 2), and "encouraging coworkers to share digital resources" (Item 18). Active involvement in online discussions or forums on smart governance (Item 19), as well as creating or sharing informative content (Item 21), are also central to this dimension. It emphasizes that civil servants' commitment to smart governance surpasses formal obligations (Organ, 1988), involving proactive capacity-building efforts and the promotion of best digital practices in the workplace (Trenerry et al., 2021). This dimension represents a form of civic engagement in digital spaces that advances broader organizational goals, reflecting the importance of active participation in the e-government ecosystem (Gupta et al., 2021).

Discussion

This study makes a significant socio-cultural contribution by extending the understanding of OCB into the digital realm, interpreting how the public services ethos is negotiated in technology-pervasive environments. While OCB was traditionally framed within face-to-face interactions and physical contexts (Andrade and Neves 2022), our findings reveal that prosocial voluntary behaviours not only persist but also adapt, thrive, and take on new cultural forms in increasingly digitized work environments, re-embedding digital labour within social ethics (Trenerry et al. 2021). We propose that Digital OCB serves as a critical theoretical and cultural bridge between classical OCB and online participation culture, offering a new lens to analyse the negotiation of participatory values within the hierarchical of the smart city bureaucracy (Jenkins 2014).

The robust EFA results (KMO = 0.853; Bartlett's $p < 0.001$) empirically confirm Digital OCB as a multidimensional construct, collectively explaining 50.7% of the total variance. This structural validation quantitively maps the emerging cultural architecture of digital bureaucracy into four dimensions: Digital Altruism, Digital civic virtue, digital conscientiousness and digital voluntary engagement. finding supports the theoretical evolution of Organ's (1988) Organizational Citizenship behaviour, adapted for digitally mediated work environments (Putra et al., 2024), and aligns with Abbasi et al. (2025) in recognizing that voluntary work behaviour now extends beyond physical spaces into virtual platforms. It also intersects with Social Exchange Theory (Blau, 1964), Perceived Organizational Support (Eisenberger et al., 1986), and Online Participation Culture (Jenkins, 2006) to explain motivation for digital extra-role behaviour.

The first dimension, Digital Altruism, signifies the emergence of a new norm of digital solidarity within the bureaucracy, encompassing behaviours like proactively assisting colleagues with digital systems and knowledge-sharing via online platforms (Andrade and Neves 2022). This behaviour is a cultural manifestation of reciprocal exchange, demonstrating how civil servants who perceive organizational support reciprocate through voluntary digital mentoring, thereby socially stabilizing the digital ecosystem. In digital contexts, this altruism manifests as technical assistance or knowledge-sharing via online platforms, aligning with Michalová & Maršíková (2023) and Dong et al. (2023) on virtual prosocial behaviour essential for e-governance.

Digital Civic Virtue captures the internalization of digital ethics and public responsibility into the civil servant's role, reflecting an active digital citizenship. This dimensions emphasize how awareness of technology's broader societal impacts, respectful online communication, and promoting safe technology use have become integral to the professional identity a cultural performance of public trust in the digital age. This mirrors the civic virtue component of OCB (Organ, 1988) while incorporating principles of online participation culture (Jenkins, 2006; Jenkins, 2009), with digital ethics emphasized by Asimakopoulos et al. (2025). Digital Conscientiousness should be interpreted as a cultural shift from physical supervision to internalized digital autonomy. It involves deliberately and innovatively applying technology to exceed formal requirements, suggesting that digital professionalism now demands a voluntary self-governance over one's digital actions, strongly linked to adaptive digital competence and literacy. involves adopting digital policies with a positive attitude, participating in governance discussions, and consistently leveraging technology to enhance efficiency behaviours rooted in the conscientiousness element of OCB (Organ, 1988) and strengthened by digital literacy (Gilster, 1997; Sari et al., 2024) and adaptive digital competence (Li et al., 2022).

Finally, Digital Voluntary Engagement captures a proactive socio-political engagement that challenges rigid bureaucratic hierarchy. This dimensions involves peer training, resource sharing, and contributing to governance forums, acting as a direct institutionalization of online participation culture where civil servants voluntarily claim the role of 'co-creators', signalling a profound social change in the ownership of public innovation. This dimension extends OCB's extra-role commitment (Organ, 1988), aligns with online participation culture (Jenkins, 2006), and reflects smart governance participation (Gupta et al., 2021) as well as capacity-building roles highlighted by Trenerry et al. (2021). Altogether, Digital OCB emerges as a theoretical extension of traditional OCB into the digital realm, grounded in SET and POS, and sustained by participatory culture and digital literacy—representing a critical competency framework for smart city governance

Specifically, the identification of four Digital OCB dimensions enriches SET (Blau 2017) and POS (Eisenberger et al. 2025) by demonstrating the validation of a new 'digital social contract,' where organizational support fosters various forms of voluntary cultural and digital contributions, transcending narrow technical performance metrics. Dimensions such as digital altruism and digital voluntary engagement indicate that civil servants who feel supported respond by helping others and actively participating in the digital ecosystem (Eriksson et al. 2022). Likewise, Digital Civic Virtue and Digital Conscientiousness illustrate how digital literacy and online participation culture shape responsible and proactive civic behaviour in the digital sphere, enhancing the concept of digital literacy within organizational settings (Sari et al. 2024).

This study also stands among the first to conceptualize and empirically validate Digital OCB through EFA in Indonesia's public sector. addressing a significant literature gap that largely focused on technology adoption (TAM/UTAUT) while overlooking the post-adoption, discretionary cultural behaviours mediated through digital

platforms (Davis and Granić 2024b; Venkatesh 2022). Consequently, our findings establish a robust theoretical and methodological foundation for future research on the role of discretionary behaviours in the success of digital transformation initiatives.

This study provides significant practical implications for local governments, especially in the context of Indonesia's "100 Smart City Movement" (Rachmawati et al. 2021). First, the validated instrument offers public administrators a diagnostic tool to assess the cultural readiness and ethical commitment of civil servants, allowing for a more nuanced mapping of the voluntary social capital essential for sustainable digital transformation (Kociuba et al. 2023). This tool can help identify strengths and gaps in the digital human resource capacity essential for smart city development.

Second, understanding Digital OCB dimensions can inform more targeted capacity-building programs for civil servants. For instance, to strengthen digital altruism, agencies can promote knowledge-sharing platforms or offer incentives for digital peer coaching (Zamiri and Esmaeili 2024). To foster digital civic virtue, they can enhance training on digital ethics and cybersecurity awareness, alongside opening digital participation channels for policy input (Asimakopoulos et al. 2025). To support digital conscientiousness, organizations may provide access to innovative digital tools and train civil servants to use them optimally for operational efficiency (Aminah and Saksono 2021). Lastly, to encourage Digital Voluntary Engagement, governments can create opportunities for civil servants to contribute to smart governance projects beyond their core duties or facilitate digital communities of practice (Haskasap et al. 2022).

Third, recognizing and rewarding Digital OCB is essential to promote such behaviour (Eisenberger et al. 2020). Finally, incorporating digital OCB metrics into performance evaluation system is not merely a technical adjustment, but a strategic cultural intervention required to acknowledge invisible socio-digital contributions and formally legitimize the new work culture emerging in the smart city bureaucracy.. By fostering Digital OCB, public organizations can cultivate a sustainable culture of digital innovation, improve operational efficiency, and accelerate the realization of a more effective and responsive Smart City vision (Zhang et al. 2022).

CONCLUSION

This research offers a crucial socio-cultural interpretation through the conceptual development and empirical validation of Digital OCB, effectively defining the voluntary, extra role digital labor of civil servants in the era of pervasive technology. The analysis, drawing on data from 397 civil servants empirically identified four dimensions- digital altruism, digital civic virtue, digital conscientiousness, and digital voluntary engagement- which collectively map the emerging cultural architecture of digital bureaucracy. These findings demonstrates that a civil servant's contribution in the digital era transcends mere technical capabilities, being fundamentally rooted in voluntarily performed ethics of collaboration, social responsibility and proactive initiative. Digital OCB stands as a critical theoretical bridge, expanding SET and POS to interpret digital reciprocity, and demonstrating how the ethics of online participation culture are negotiated within formal public bureaucratic dynamics.

From a practical perspective, this study provides an important foothold for policymakers in designing a strategy to strengthen the capacity of civil servants that is more adaptive to the demands of digitalization. The validated instrument allows for more accurate mapping of digital voluntary behavior, which can be used in the preparation of training programs, incentives, and a more inclusive performance evaluation system. Fostering and formally recognizing Digital OCB is more than a technical effort, it is a strategic cultural investment required to cultivate an innovative and responsive bureaucracy that possesses the social agility necessary for effective public service delivery. Ultimately, Digital OCB emerges not simply as a behavioral concept, but as the very locus of new work culture-a formative synergy between the technological infrastructure and the human, social capacity required for a legitimate smart city.

LIMITATIONS AND RECOMENDATIONS

Despite its significant contributions, this study has several limitations. First, the EFA was conducted within the specific cultural and bureaucratic context of Central Java, Indonesia, which necessitates caution regarding the cross-cultural transferability of the dimensional structure (Legate et al. 2023). Although the results revealed a strong factor structure, researchers must conduct confirmatory studies (Confirmatory Factor Analysis/CFA) to further validate the proposed dimensional structure across different and larger samples (Sureshchandar 2023), including tests for measurement invariance across demographic or organizational groups.

Second, reliance on self-reported data raises the inherent methodological challenge of social desirability bias. This calls for future research to move beyond self-assessment to capture the performed social reality of Digital OCB (Kock et al. 2021). Future studies should prioritize mixed-methods approaches, particularly emphasizing in-

depth interviews and ethnographic observations to capture the lived experiences and subjective narratives of civil servants practicing Digital OCB (Arias Valencia 2022). furthermore, the cross-sectional design limits our ability to trace the causal evolution of this cultural script. Longitudinal studies are needed to interpret how the meaning and performance of Digital OCB change over time in response to shifting policy or technology (Bougie and Sekaran 2019).

Based on these limitations, we propose several directions for future research. First, researchers should apply CFA and Structural Equation Modelling (SEM) to test theoretical models integrating Digital OCB as a mediating or moderating variable between organizational factors (e.g., digital leadership, organizational culture, technological support) and outcomes such as Smart City performance or citizen satisfaction (Hair et al. 2019). Second, comparative studies across countries or between public and private sectors can assess the dimensional invariance of Digital OCB in various cultural and organizational contexts (Żemojtel-Piotrowska and Piotrowski 2023). Finally, qualitative research can offer deeper insights into the subjective experiences of civil servants practicing Digital OCB and the challenges they encounter, thereby complementing the quantitative findings (Akcam et al. 2019).

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