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Transformation of Urban Social Interaction in the Era of Artificial Intelligence and Digital Society

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ABSTRACT

The rapid integration of artificial intelligence (AI) and digital technologies into everyday urban life has fundamentally reshaped the patterns, quality, and dynamics of social interaction in urban communities. This study examined the transformation of social interaction among urban populations in Indonesia amid the proliferation of AI-driven platforms, smart city infrastructure, and digital communication systems. A mixed-methods approach was employed, combining a quantitative survey of 480 urban residents across five Indonesian cities with qualitative interviews involving 32 key informants. Social interaction transformation was assessed across five dimensions: communication modality, social trust, community cohesion, digital inclusion, and civic participation. Results indicate a significant shift toward digitally mediated social interaction, with 68.7% of respondents reporting that online interaction has become their primary mode of daily communication. AI-enabled platforms significantly predicted urban social cohesion (β=0.521, p<0.001), while digital literacy moderated the relationship between AI adoption and positive social outcomes. Alarming disparities were identified between high-income metropolitan areas and lower-income urban peripheries, reflecting a persistent digital divide that exacerbates social inequality. The metaverse, algorithmic governance, and AI chatbots emerged as novel interaction environments that simultaneously democratize and fragment social engagement. These findings contribute to an emerging theoretical framework positioning digital transformation as an interaction-driven nexus between society, technology, and urban governance.

Keywords: *Artificial Intelligence; Digital Society; Social Interaction; Smart Cities; Urban Transformation.*

INTRODUCTION

The convergence of artificial intelligence and digital technologies is driving a profound reshaping of how urban populations communicate, collaborate, and create shared meaning. In cities worldwide, the spread of AI-powered communication tools, algorithmic recommendation engines, and smart-city systems is reconfiguring the underlying architecture of social interaction: conversations that were once grounded

primarily in place and face-to-face contact increasingly unfold across digitally mediated networks and platform environments. These technologies personalize information flows, shape what people see and who they connect with, and enable new forms of collective action and service delivery driven by data analytics. As a result, urban life is becoming organized around data-driven services, algorithmically curated social experiences, and platform ecosystems that influence norms, trust relationships, and civic engagement patterns. This rapid transformation carries both opportunities, such as enhanced connectivity, more responsive public services, and novel channels for community mobilization, and risks, including algorithmic bias, privacy trade-offs, and the potential for digital exclusion among those with limited access or literacy (Van Veldhoven & Vanthienen, 2021; Dwivedi et al., 2023).

Indonesia offers a salient example of this digital and AI-driven transition. As the world's fourth most populous country and one of Southeast Asia's fastest-growing digital economies, its cities have seen rapid increases in internet access, smartphone ownership, and the use of AI-enabled platforms. By 2023, Indonesia had over 215 million internet users, and urban residents demonstrated markedly higher levels of social-media engagement and AI-mediated communication than rural populations. This intensification of digital connectivity reshapes everyday urban life: it alters how neighbors form and maintain social ties, how civic information circulates, and how people mobilize around local issues. The shift presents opportunities to strengthen civic participation, deliver targeted public services, and build community resilience through data-informed interventions, but it also raises concerns about unequal access, the amplification of misinformation, and new forms of social fragmentation if digital tools and policies are not deliberately designed to be inclusive and trustworthy.

The rise of smart-city paradigms has accelerated the digital transformation of urban life by embedding AI, big-data analytics, Internet of Things (IoT) networks, and digital-twin technologies into the fabric of city governance. These integrated systems change how residents access public services, navigate physical spaces, and interact with one another by enabling real-time sensing, predictive resource allocation, and automated decision support. Bokhari and Myeong (2022) and Wolniak and Stecuła (2024) describe how such infrastructures shift routine urban functions, transport, energy, waste, and public safety, toward data-driven models that foreground efficiency and responsiveness. He and Chen (2024) show that AI-assisted urban design and planning tools are not only reshaping the physical form of cities (street layouts, land use, and service locations) but also altering the social dynamics that emerge from those forms, such as patterns of mobility, access to amenities, and neighborhood cohesion. Son et al. (2023) further identify algorithmic urban planning as a transformative mechanism for smart and sustainable development, one that reconfigures notions of citizenship and channels for social participation by determining whose needs are prioritized in automated planning processes. Together, these studies suggest that while smart-city technologies offer opportunities to enhance service delivery and sustainability, they also raise important questions about equity, participation, and the social consequences of delegating planning choices to algorithmic systems.

The integration of AI into everyday communication tools has reshaped micro-social dynamics, altering language use, interpersonal interactions, and the foundations of social trust. Hohenstein et al. (2021) show that AI-mediated communication influences not only stylistic elements of language (tone, brevity, and phrasing) but also the nature of relationships, prompting questions about authenticity, reciprocity, and the emotional depth of exchanges when machines partially mediate conversation. At the same time,

generative AI introduces novel risks: synthetic voices and text can enable digital deception and sophisticated social-engineering tactics that undermine users' ability to judge source credibility and erode interpersonal trust in online settings (Schmitt & Flechais, 2023). These dynamics have practical implications for vulnerable domains such as mental health support, where Balcombe (2023) documents how AI chatbots are changing patterns of help-seeking and emotional expression, offering increased access but also raising concerns about the quality, empathy, and continuity of care. Together, these studies suggest that while AI can enrich communication and expand support channels, it also demands careful design, transparency, and ethical safeguards to preserve human relational qualities and protect trust in digital social environments.

The metaverse emerges as a particularly disruptive frontier for urban social interaction, blurring boundaries between physical and virtual city life. Allam et al. (2022) conceptualize the metaverse as a virtual extension of smart-city infrastructures, offering new possibilities for service delivery, remote participation, and experiential urban design while also raising complex questions about environmental, economic, and social sustainability. Bibri et al. (2022) extend this view by framing the metaverse as a data-driven platform of smart urbanism, one that restructures institutional practices and daily life through pervasive data collection, platform governance, and new modes of social organization. Bibri and Allam (2022) further analyze post-pandemic urban governance in the context of surveillance capitalism, highlighting how power asymmetries can be amplified in AI-mediated environments where platform owners control data flows, monetization mechanisms, and the architectures that shape civic interaction. Together, these perspectives suggest that while the metaverse could enable innovative forms of engagement, planning, and service access, it also risks deepening inequalities, concentrating control over urban experiences, and creating novel governance and ethical challenges that cities must proactively address.

Although research on AI and digital transformation has expanded globally, there remains a relative paucity of studies that focus on how these technologies reshape social interaction patterns, specifically within Indonesian cities. This study, therefore, addresses that gap by examining the multidimensional ways urban social life is being transformed in the AI era, paying particular attention to how AI literacy, the quality of digital infrastructure, and socioeconomic inequalities mediate these changes. Using Van Veldhoven and Vanthienen's (2021) interaction-driven framework, which treats digital transformation as an ongoing interplay among business practices, societal norms, and technological affordances, the research explores how platform architectures, recommendation algorithms, and AI-enabled services reconfigure everyday routines, civic engagement, and community ties in Indonesian urban settings. By situating local empirical findings within this broader theoretical lens, the study aims to advance sociological understanding of AI-mediated urban change and to identify which combinations of literacy, access, and policy interventions might foster more inclusive and democratic digital futures in Indonesian cities.

The study has four primary objectives. First, to describe the extent and character of social-interactional change among Indonesian urban communities in the AI era, documenting how everyday modes of communication, civic engagement, and neighborhood ties are being reshaped by AI-enabled platforms and services. Second, to analyze the relationship between AI and digital literacy and measures of urban social cohesion, assessing whether higher levels of literacy and critical engagement with AI tools strengthen trust, reciprocity, and collective action, or instead contribute to fragmentation. Third, to identify the sociodemographic and structural factors that mediate AI-driven

shifts in social interaction, such as age, education, income, digital infrastructure quality, and occupational patterns, so we can understand which groups are most affected and why. Fourth, to develop evidence-based recommendations for governance and policy frameworks that promote inclusive, equitable, and participatory digital social transformation in cities, including suggestions for literacy programs, infrastructure investment, platform accountability, and community co-design of AI applications. Together, these objectives aim to link empirical description with actionable guidance to help Indonesian cities steer AI adoption toward stronger, fairer social outcomes.

METHOD

This study used a convergent mixed-methods design, combining quantitative survey data with in-depth qualitative interviews to capture both the scale and the meaning of social-interaction changes in the AI era. Fieldwork took place from February to August 2024 across five Indonesian cities selected to span a range of urban contexts and development stages: Jakarta (metropolitan), Surabaya (large city), Bandung (medium city), Yogyakarta (small city), and Semarang (emerging city). The quantitative component measured patterns of platform use, AI and digital literacy, frequency and types of online versus face-to-face interaction, and indicators of social cohesion, while the qualitative interviews explored participants' lived experiences, perceptions of AI-mediated communication, and local norms that shape digital behaviour. By intentionally sampling cities with differing scales and levels of digital infrastructure, the study examined how city size, service availability, and technological maturity mediate AI-driven social change, enabling triangulation of statistical trends with contextualized narratives to produce a richer, more policy-relevant understanding.

The quantitative component used a stratified random sampling strategy aimed at urban residents aged 18–55 years. Sample size calculation followed the Slovin formula with a margin of error of 4.5%, which produced a minimum required sample of 480 respondents; proportional allocation to each city was then determined using urban population figures from the 2023 Indonesian National Census to ensure representativeness across metropolitan, large, medium, small, and emerging urban contexts. Data were collected through a validated self-administered online questionnaire covering five dimensions of social-interaction transformation: (1) communication modality shift; (2) AI-mediated social trust; (3) digital community cohesion; (4) digital inclusion and equity; and (5) AI-enabled civic participation. The instrument comprised 45 Likert-scale items and demonstrated strong internal consistency (Cronbach's alpha = 0.89), with reliability confirmed across all subscales.

The qualitative strand comprised 32 in-depth semi-structured interviews with purposively selected key informants, including urban planners, community leaders, technology entrepreneurs, civil-society actors, and members of marginalized urban groups. Interview topics probed lived experiences of AI-driven social change, perceptions of digital inclusion and exclusion, and normative assessments of algorithmic governance and its effects on everyday community life. All interviews were conducted in Bahasa Indonesia, audio-recorded with participants' consent, transcribed verbatim, and subjected to thematic analysis following Braun and Clarke's six-phase procedure.

Quantitative analyses were carried out in SPSS version 27.0. Descriptive statistics summarized sociodemographic characteristics and study variables (means, standard deviations, frequencies, and percentages). Pearson correlation coefficients assessed bivariate associations between AI/digital literacy indicators and social-cohesion

outcomes. Multiple linear regression models identified independent predictors of social-interaction transformation indices while controlling for sociodemographic covariates (age, gender, education, occupation, and city). Interaction terms were tested to examine whether digital literacy moderated the relationship between AI adoption and social cohesion outcomes. Statistical significance was set at $p < 0.05$, and standard diagnostic checks (multicollinearity, residual distribution, heteroscedasticity) were performed to ensure model robustness. Qualitative and quantitative findings were integrated through joint display analysis to surface convergences, divergences, and complementarities between numerical patterns and participants' narratives.

Ethical approval was obtained from the Social Science Research Ethics Committee of Universitas Indonesia (Ref. No. SSREC-UI-2024-0219). All participants provided written informed consent, and data anonymization procedures were applied throughout analysis and reporting to safeguard participant confidentiality.

RESULTS AND DISCUSSION

A total of 512 questionnaires were distributed across the five study cities, and 480 valid responses were retained for analysis, yielding a high overall response rate of 93.8%. Respondents represented a broad cross-section of urban residents in terms of age, gender, education, occupation, and household income; detailed sociodemographic breakdowns are summarized in Table 1. Key measures of AI and digital literacy (including self-rated proficiency with AI tools, frequency of use, and ability to critically evaluate algorithmic outputs) and primary social-interaction outcomes (such as frequency of online versus face-to-face contact, participation in civic activities, and perceived neighborhood cohesion) are reported in Table 2. The large sample size and high response rate support robust subgroup analyses by city and demographic category, enabling comparisons of literacy and interaction patterns across metropolitan, large, medium, small, and emerging urban contexts.

Table 1. Sociodemographic Characteristics of Study Participants (n=480)

Characteristic	n	Percentage (%)
Sex		
Male	228	47.5
Female	252	52.5
Age Group (years)		
18–25	134	27.9
26–35	178	37.1
36–45	112	23.3
46–55	56	11.7
City		
Jakarta (Metropolitan)	120	25.0
Surabaya (Large City)	108	22.5
Bandung (Medium City)	96	20.0
Yogyakarta (Small City)	84	17.5
Semarang (Emerging City)	72	15.0

Characteristic	n	Percentage (%)
Educational Level		
Senior High School	86	17.9
Undergraduate (D3/S1)	294	61.3
Postgraduate (S2/S3)	100	20.8
Daily Internet Use		
>8 hours/day	213	44.4
4–8 hours/day	184	38.3
<4 hours/day	83	17.3
Primary Digital Platform Used		
Social Media (Instagram/TikTok)	241	50.2
Messaging Apps (WhatsApp)	156	32.5
AI Assistants (ChatGPT etc.)	83	17.3

Among respondents, 68.7% indicated that online or AI-mediated interaction has become their primary mode of daily communication, while just 31.3% identified face-to-face contact as their main channel. The urban scale gradient was clear: Jakarta showed the strongest shift to digital-first communication (78.4% reporting online as primary), whereas Semarang exhibited the smallest shift (55.3%), a pattern shown in Figure 1. These results reflect how larger, more digitally dense cities tend to migrate faster toward platform-mediated social life. The observed pattern aligns with Van Veldhoven and Vanthienen's (2021) interaction-driven view of digital transformation, where business, society, and technology co-evolve, and supports Burrell and Fourcade's (2021) argument that contemporary social organization is increasingly shaped by algorithmic logics that structure attention, connections, and information flows. Overall, the data suggest that AI-enabled platforms are now central to everyday interaction for a majority of urban Indonesians, with variation across city types that likely reflects differences in infrastructure, occupational demands, and cultural practices.

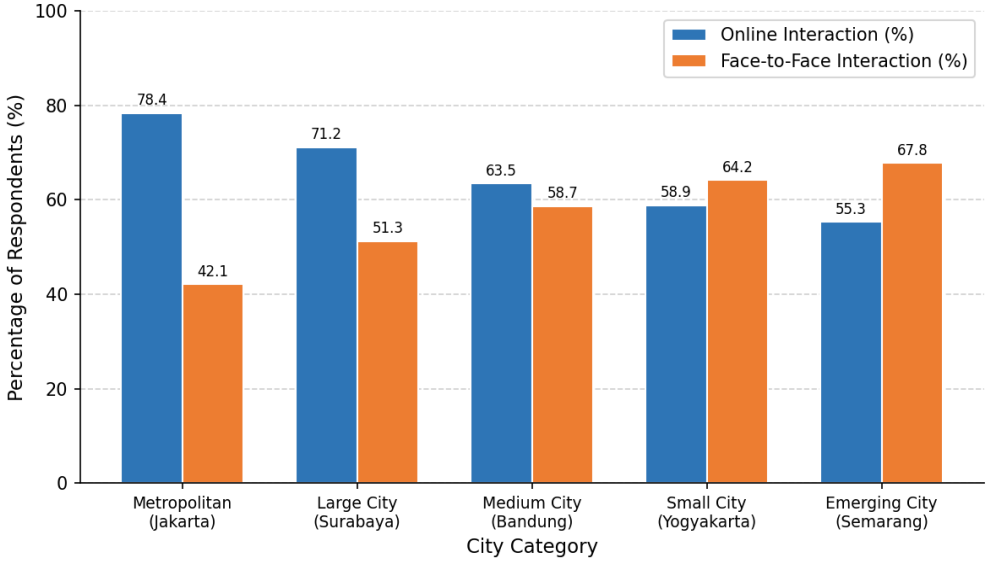

Figure 1. Shift in Social Interaction Patterns Across Urban Categories in The AI Era (n= 480)

The mean AI/digital literacy score was 62.4 (SD=14.7; range 18-98). Participants with higher educational attainment demonstrated significantly greater AI literacy (postgraduate mean=76.3 vs. senior high school mean=51.8, $p<0.001$). Metropolitan residents outperformed smaller city counterparts (Jakarta mean=71.2 vs. Semarang mean=54.6, $p<0.001$), reflecting the infrastructural digital divide documented by Das (2024) and Al-Raeei (2024) in smart city development literature. Haluza and Jungwirth (2023) identified comparable disparities in their analysis of AI and societal megatrends, highlighting that digital stratification represents one of the most consequential social impacts of AI diffusion.

Table 2. Descriptive Statistics of Key Study Variables by City (n=480)

City	AI Literacy (Mean±SD)	Social Cohesion (Mean±SD)	Online Interaction (%)	Civic Participation (Mean±SD)	Digital Inclusion Index
Jakarta	71.2±12.3	68.4±14.1	78.4	72.1±11.8	74.3
Surabaya	65.8±13.7	63.2±15.4	71.2	67.4±12.9	68.7
Bandung	61.3±14.2	60.1±16.0	63.5	63.8±13.5	64.2
Yogyakarta	57.9±15.1	65.4±13.8	58.9	68.2±11.4	61.5
Semarang	54.6±16.4	58.7±17.2	55.3	60.1±14.7	57.8
Total	**62.4±14.7**	**63.1±15.4**	**68.7**	**66.3±13.1**	**65.3**

Pearson correlation analysis revealed significant positive associations between AI/digital literacy and all social outcome variables: social cohesion ($r=0.581$, $p<0.001$), civic participation ($r=0.493$, $p<0.001$), and digital inclusion index ($r=0.612$, $p<0.001$). The scatter plot in Figure 2 illustrates the literacy-cohesion relationship. Notably, Yogyakarta exhibited a higher social cohesion score relative to its AI literacy level, suggesting that strong traditional community bonds (gotong royong) partially buffer digitization-induced social fragmentation, a finding that resonates with qualitative informants who emphasized the resilience of face-to-face community practices in smaller urban centers.

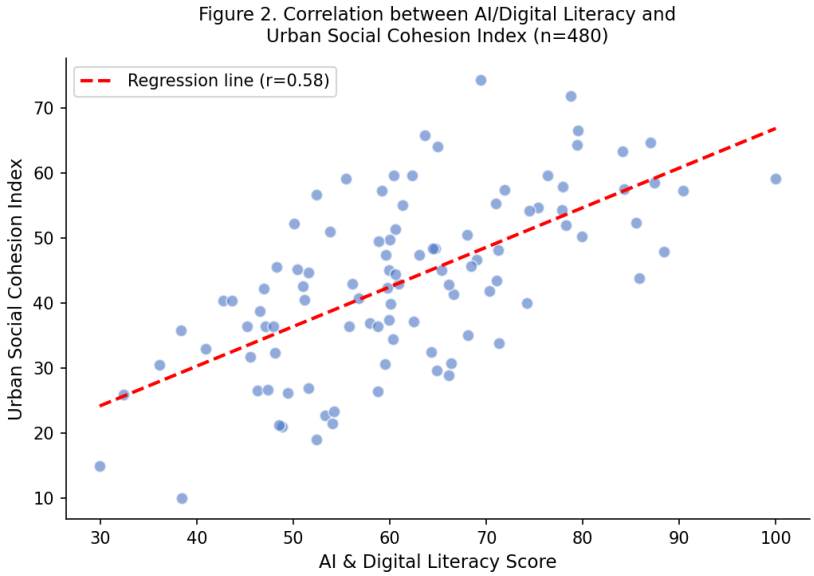

Figure 2. Correlation between AI/Digital Literacy and Urban Social Cohesion Index (n= 480)

The positive association visualized in Figure 2 establishes a clear baseline; however, to determine whether AI/digital literacy remains a robust predictor when controlling for factors such as age, sex, education, city size, and daily internet use, the study utilized multiple regression modeling. These findings are systematically summarized in Table 3.

Table 3. Multiple Linear Regression: Predictors of Urban Social Cohesion Index (n=480)

Variable	β	SE	t-value	p-value
AI/Digital Literacy Score	0.521	0.038	13.71	<0.001
Age (years)	0.072	0.031	2.32	0.021
Sex (Female vs Male)	0.094	0.047	2.00	0.046
Education (Undergraduate)	0.183	0.056	3.27	0.001
Education (Postgraduate)	0.211	0.071	2.97	0.003
City Size (Metropolitan)	0.158	0.064	2.47	0.014
Daily Internet Use (>8 hrs)	0.137	0.052	2.63	0.009
AI Literacy × Internet Use (interact)	0.098	0.043	2.28	0.023
Constant	12.45	3.58	3.48	<0.001

***Note**: R^2=0.612; Adjusted R^2=0.604; F(8,471)=93.27, p<0.001; SE=Standard Error*

Multiple regression analysis (Table 3) confirmed AI/digital literacy as the strongest independent predictor of urban social cohesion (β=0.521, p<0.001). The significant interaction term between AI literacy and internet use frequency (β=0.098, p=0.023) indicates that intensive internet users benefit most from high AI literacy in terms of social

cohesion outcomes. The overall model explained 61.2% of variance in social cohesion (R^2=0.612), demonstrating the substantial explanatory power of AI/digital literacy as a social determinant in urban contexts.

These findings resonate with Dionisio et al.'s (2023) systematic review of digital social innovations for Sustainable Development Goals, which emphasized that digital technologies' contribution to social goals is contingent upon equitable literacy distribution. Krishna et al. (2022) further demonstrated that socially situated AI enables learning from human interaction, suggesting that AI systems embedded in community contexts hold potential for strengthening rather than fragmenting social bonds when appropriately designed.

Qualitative interview themes highlighted three dominant experiential patterns. First, "digital social acceleration" was described by younger, high-literacy respondents who welcomed AI-mediated interaction for expanding social networks and accessing diverse perspectives. Second, "algorithmic social anxiety" was reported predominantly by middle-aged respondents who expressed concerns about privacy, authenticity, and the colonization of social time by recommendation algorithms, consistent with Burrell and Fourcade's (2021) critique of the "society of algorithms." Third, "digital social exclusion" was articulated by lower-income and lower-literacy respondents who experienced AI-driven social transformation as deepening rather than bridging social divides, a pattern documented across multiple contexts by Mueller (2022) through the lens of corporate digital responsibility.

The metaverse dimension of social interaction transformation deserves particular attention. While metaverse adoption among Indonesian urban populations remained nascent (12.3% reporting regular use), awareness was high (78.9%), and qualitative informants, particularly urban planners and technology entrepreneurs, anticipated significant growth. Bibri et al.'s (2022) framework of the metaverse as data-driven smart urbanism provides a critical lens for understanding how virtual social environments may extend and complicate existing urban social hierarchies rather than transcending them. Allam et al.'s (2022) smart cities framework further foregrounds the governance challenges of ensuring social sustainability within AI-mediated urban futures.

Ye et al. (2022) contributed a human-centered perspective through their advocacy for urban digital twins that prioritize community infrastructure resilience and social participation. This perspective aligns with Das's (2024) analysis of the symbiotic relationship between digital transformation and sustainable smart city governance. The evidence from this study suggests that without deliberate sociotechnical governance frameworks that center digital equity and AI literacy development, the default trajectory of AI-driven urban social transformation is likely to amplify rather than ameliorate existing social inequalities, a concern echoed by Al-Raeei's (2024) analysis of AI solutions for sustainable urbanization

CONCLUSIONS

This study provides comprehensive evidence that AI and digital technologies are fundamentally transforming the patterns, modalities, and quality of social interaction in Indonesian urban communities. AI/digital literacy emerged as the most powerful predictor of positive social cohesion outcomes, and significant disparities were documented across city types, educational levels, and socioeconomic strata. The transformation is characterized by a pronounced shift toward digitally mediated

interaction, an emergent metaverse social frontier, and persistent digital divide dynamics that risk entrenching social inequality in the AI era.

Based on these findings, four strategic recommendations are proposed. First, urban digital literacy programs should be mainstreamed within city governance frameworks, with particular focus on bridging the metropolitan-peripheral literacy gap to ensure equitable social participation. Second, smart city AI governance frameworks should incorporate explicit social cohesion impact assessments, drawing on Bokhari and Myeong's (2022) social innovation perspective on AI in smart cities. Third, corporate digital responsibility frameworks, as articulated by Mueller (2022), should require AI platform providers operating in Indonesian urban markets to implement algorithmic transparency and social equity auditing mechanisms. Fourth, community-centered AI interaction design principles, informed by Krishna et al.'s (2022) socially situated AI model, should guide the development of AI systems deployed in urban social infrastructure.

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