

# UTILISATION OF ARTIFICIAL INTELLIGENCE

for Envisioning Smart City  
and Modern Urban Planning





**Author**

Mario Hartanto

**Editor**

Achmed Faiz Yudha Siregar

**Designer & Layouter**

Semeion Bintang Ridho Aunillah



## Background

Cities are pivotal regions to one country's citizens because they provide tangible and intangible infrastructure for individuals to live, work, and self-actualization. As the city increases in population, it creates more issues with energy management, environmental resources, traffic congestion, health, social inequality, and others.<sup>1</sup> With these problems, government and city stakeholders initiated smart city solutions to ensure the city's efficiency and reliability as a living area. In Indonesia itself, smart cities have already been implemented and one of the prominent examples exists in JAKI (Jakarta Kini). JAKI is an integrated application launched by the DKI Jakarta Government where Jakarta citizens can easily report various city problems and the parking management systems where congestion is reduced.<sup>2</sup>

As technology advances, smart cities are utilising technology by implementing Artificial Intelligence (AI) to optimise urban functionality.<sup>3</sup> Recently, AI has offered more effectiveness and efficiency in smart city initiatives. The emergence of AI and its machine learning helps urban planners to provide many solutions for different areas. From urban management, decision-making processes, and new economic opportunities, to building a more sustainable impact. The advancement of AI has brought applicable solutions to the city such as automated vehicles, real-time parking sensors, regular monitoring, smart home applications, and many more.<sup>4</sup> One concrete implementation is an IoT (Internet of Things) park bench integrated in Paris where the bench can collect information and monitor pollution levels, temperature, and atmospheric pressure.<sup>5</sup>

<sup>1</sup> Viorel, Paul. "Dua Masalah Utama Perkotaan yang Dapat Dipecahkan oleh IOT dan AI." *IloT World*, 12 Desember 2023. <https://www.iioT-world.com/smart-cities-buildings-infrastructure/smart-cities/two-main-urban-problems-that-iot-and-ai-can-menyelesaikan/>.

<sup>2</sup> Dewi, Afika Sari, dan Bhakti Nur Avianto. "Implementasi 'Jakarta Smart City' dalam Pelayanan Terpadu Satu Pintu: Kebutuhan Sehari-hari di Kota Jakarta Selatan." *Jurnal Penelitian Ilmu Sosial, Ekonomi, dan Manajemen* 02, tidak. 9 (2023): 2051–63.

<sup>3</sup> Yigitcanlar, Tan, Nayomi Kankanamge, Massimo Regona, Andres Ruiz Maldonado, Bridget Rowan, Alex Ryu, Kevin C. Desouza, Juan M. Corchado, Rashid Mehmood, dan Rita Yi Li. "Teknologi Kecerdasan Buatan dan Konsep Perencanaan dan Pembangunan Kota Terkait: Bagaimana Mereka Dianggap dan Dimanfaatkan di Australia?" *Jurnal Inovasi Terbuka: Teknologi, Pasar, dan Kompleksitas* 6, no. 4 (Desember 2020): 187. <https://doi.org/10.3390/joitmc6040187>.

<sup>4</sup> BP, Ashwini, Savithramma RM, dan R Sumathi. "Kecerdasan Buatan dalam Aplikasi Kota Cerdas: Suatu Tinjauan." *Konferensi Internasional ke-6 tentang Sistem Komputasi dan Kontrol Cerdas (ICICCS) ke-6 tahun 2022*, 25 Mei 2022. <https://doi.org/10.1109/iciccs53718.2022.9788152>.

<sup>5</sup> 14 kasus penggunaan AI teratas: Kecerdasan Buatan di kota pintar - ... Diakses pada 11 Maret 2024. <https://www.techopedia.com/top-14-ai-use-cases-artificial-intelligence-in-smart-cities/2/34049>.

The power of AI to bring more effectiveness is not something that can be taken for granted nowadays in many countries. Data per 2024 shows that global AI deployment in 2024 has reached 35% and 42% in AI exploration.<sup>6</sup> Therefore, the urgency for implementing AI is more significant and needs to be studied, especially in Indonesia with a dense population. This writing is focused on discovering how the utilisation of AI transforms the advancement of urban planning. Furthermore, the writing examines the process, real examples, benefits, challenges, and progress in Indonesia, risks and concerns, and how to build better urban planning.

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<sup>6</sup> Cardillo, Anthony. "Berapa Banyak Perusahaan yang Menggunakan AI? (Data Baru)." *Topik Meledak*, 3 Maret 2024.  
<https://explodingtopics.com/blog/companies-using-ai>.







## Smart City

City is the highly organised and relatively permanent centre of the population filled with various urban communities.<sup>7</sup> With its diversion in socio-economic culture, cities are so complex and need innovative solutions to manage it. The concept of a smart city itself began in the 1990s and the “smart” term is often linked to “digitalisation”.<sup>8</sup> At first, the focus of smart city development is to integrate Information and Communication Technology (ICT) to the city's people, infrastructure, and institutions.

The smart city consists of six elements according to Giffinger et al. (2007) such as smart economy, smart environment, smart governance, smart living, smart mobility, and smart people.<sup>9</sup> The smart economy focuses on improving the business climate to drive innovations and productivity in the city. Smart environment related to building sustainable management that improves citizen's livability. Smart governance is linked to strengthening the city as a service and government stakeholders. Smart living refers to all actions that fulfil citizens' needs such as education, health, culture, entertainment, safety, etc. Smart mobility included a strategy to manage traffic and increase public space accessibility. Last, the smart people involved in social participation that was achieved through inclusive and participatory community.

<sup>7</sup> "Kota." Encyclopædia Britannica, 10 Maret 2024. <https://www.britannica.com/topic/city>.

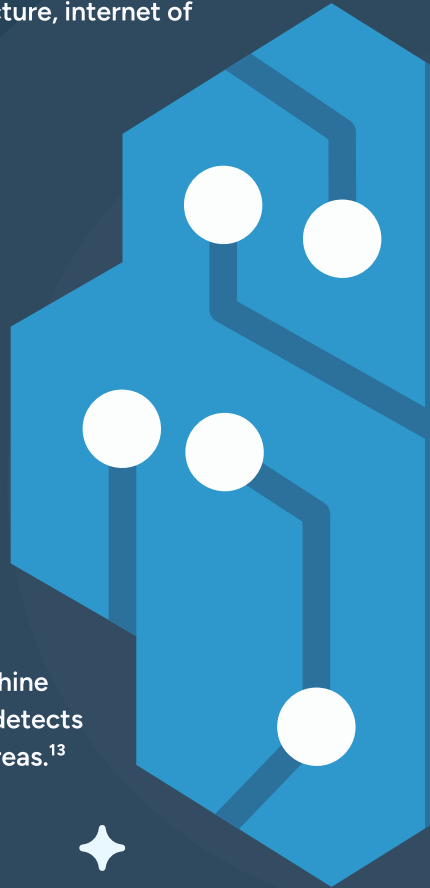
<sup>8</sup> Kusumastuti, RD, dan J Rouli, "Implementasi Kota Cerdas dan Keterlibatan Masyarakat di Indonesia." Seri Konferensi IOP: Ilmu Bumi dan Lingkungan 940, no. 1 (1 Desember 2021): 012076. <https://doi.org/10.1088/1755-1315/940/1/012076>.

<sup>9</sup> Giffinger R, Fertner C, Kramar H, Meijers E dan Pichler-Milanovic N 2007 Kota Cerdas: Peringkat Kota Menengah di Eropa Wina

Application of smart city more when the COVID-19 pandemic happens where citizen contact is limited due to social distancing. The implementation of IoT and AI then advances into the assets in grappling with United Nations Sustainable Development Goals (SDG), healthy lives, and society's well-being. IoT and AI help govern the monitoring of citizens' data through city dashboards, IT urban infrastructure, internet of health, smart community, and other initiatives.<sup>10</sup>

## → Artificial Intelligence

Artificial Intelligence (AI) is a system's ability to correctly learn, interpret, and use data to achieve specific goals and tasks through flexible adaptation.<sup>11</sup> The term was first coined by Stanford Professor John McCarthy in 1955 through the findings that humans program machines to learn what human beings do.<sup>12</sup> AI works using machine learning, a process that uses experience or data to improve the performance of the task. One concrete example of machine learning is disease recognition in healthcare where the machine learns from medical records patterns and then detects early abnormalities and risks from specific body areas.<sup>13</sup>



<sup>10</sup>Kolesnichenko, Olga, Lev Mazelis, Alexander Sotnik, Dariya Yakovleva, Sergey Amelkin, Ivan Grigorevsky, dan Yuriy Kolesnichenko. "Pemodelan Sosiologis Kota Cerdas dengan Implementasi Tujuan Pembangunan Berkelanjutan PBB." Ilmu Keberlanjutan 16, no. 2 (3 Januari 2021): 581–99. <https://doi.org/10.1007/s11625-020-00889-5>.

<sup>11</sup>Barneck, Christoph, Christoph Lutge, Alan Wagner, dan Sean Welsh. Pengantar Etika dalam Robotika dan AI. SpringerBrief, 2021.

<sup>12</sup>Universitas, Stanford. Laporan AI yang Berpusat pada Manusia, n.d.

<sup>13</sup>"Contoh Pembelajaran Mesin (ML) di Dunia Nyata." Tablo. Diakses 11 Maret 2024. <https://www.tableau.com/learn/articles/machine-learning-examples#:~:text=1,analyzing%20patterns%20through%20facial%20contours>.

Machine learning itself is categorised into three types of learning: supervised, unsupervised, and reinforcement.<sup>14</sup> Supervised learning is a method that relies on problem classification in the form of data that is labelled. Usually, the labelling process involves human efforts to examine the data. The computer then learns to predict the labels that are given.

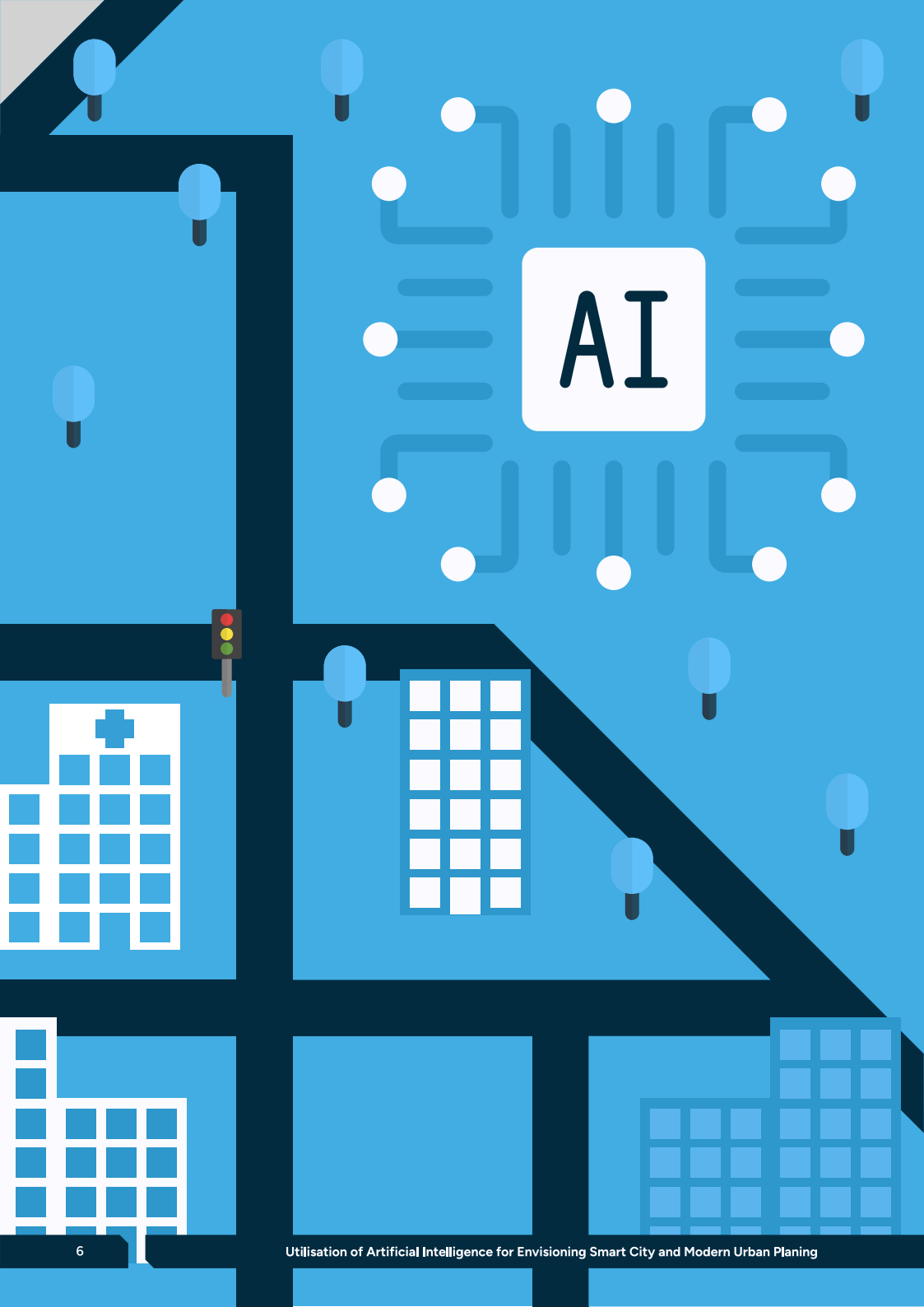
The second one is unsupervised, the method that focuses on understanding data patterns and prediction. This method involves exploratory analysis and does not require labels. Last is reinforcement where this method learns the sequences of action and heavily relies on the feedback given. These learning abilities make AI possible to perform tasks in complex situations with enormous autonomy and adaptability.

In Indonesia itself, the AI is integrated by chatbot usage to recommend users in mobile apps, data analysis in business strategy, and facial recognition to ease daily basis.<sup>15</sup> Nowadays, AI has been used in various sectors such as agriculture, creative, finance, marketing, and manufacturing, including urban planning landscapes. The utilisation of AI through urban planning manifests through smart city initiatives; the usage of information and communication technology to monitor, measure, and manage cities to improve society's quality of life.<sup>16</sup>

<sup>14</sup> Barneck, Christoph, Christoph Lutge, Alan Wagner, dan Sean Welsh. Pengantar Etika dalam Robotika dan AI. SpringerBrief, 2021.

<sup>15</sup> Cloudeka, Lintasarta. "Artificial Intelligence Di Indonesia: Perkembangan & Tantangan." Lintasarta, August 31, 2023. <https://www.cloudeka.id/id/berita/teknologi/artificial-intelligence-di-indonesia/#:~:text=Contoh%20penerapan%20AI%20di%20Indonesia,dan%20gambar%20untuk%20meningkatkan%20keamanan.>

<sup>16</sup> Lepakshi, Vijayalakshmi A., dan Prashanth C. Ranga. "Kecerdasan Buatan untuk Pengembangan Kota Cerdas." Buku Panduan Kecerdasan Buatan untuk Pembangunan Kota Cerdas, 17 Januari 2024, 60–75. [https://doi.org/10.1201/9781003225317-4.](https://doi.org/10.1201/9781003225317-4)



# → AI Functions in Urban Planning

Urban planning in city management has a pivotal role in encompassing the design and regulation of how space is used from economic functions, and physical infrastructure, to the social consequences and the activities allocation within the city.<sup>17</sup> AI is an effective tool to address urban issues by facilitating problem-oriented decisions for urban planners. AI has enabled the usage of machine learning and data analysis to make more informed and effective decisions. Peng Zhong-Ren et al. (2023) have made an AI function<sup>18</sup> framework in urban planning based on urban planner participation and autonomy of AI in the planning process:

## 1 AI-Assisted Planning

The first function is AI as an assistant in urban planning. This focused on how AI's role as an effective tool for managing big data: from data collection, processing, and performing, to visualization. In this function, AI has low autonomy and the urban planners have a dominant part in conducting the plan. AI helps to advance urban planning by creating comprehensive analysis, identifying the root cause of urban problems, interacting with related stakeholders, conducting feasible solutions, and making planning decisions.

The application of AI-assisted planning varies according to needs. First is text mining and natural language processing. Studies by Fu Li et al. (2023) show that AI has the ability to extract important information from past planning documents and provide summaries for urban planning.<sup>19</sup> This text management ability eases urban

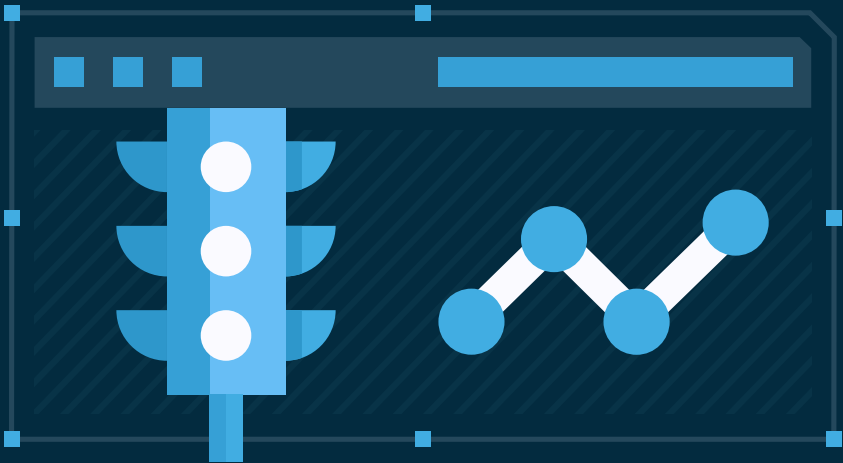
<sup>17</sup> Fainstein, SS "Perencanaan kota." <https://www.britannica.com/topic/urban-planning> Ensiklopedia Britannica, 2022.

<sup>18</sup> Peng, Zhong-Ren, Kai-Fa Lu, Yanghe Liu, dan Wei Zhai. "Jalur AI Perencanaan Kota: Dari Dukungan Perencanaan hingga Pembuatan Rencana." *Jurnal Perencanaan Pendidikan dan Penelitian*, 22 Juni 2023. <https://doi.org/10.1177/0739456x231180568>.

<sup>19</sup> Fu, X., C. Li, dan W. Zhai. "Menggunakan Pemrosesan Bahasa Alami untuk Membaca Rencana." *Jurnal Asosiasi Perencanaan Amerika* 89: 107–19. 2023.

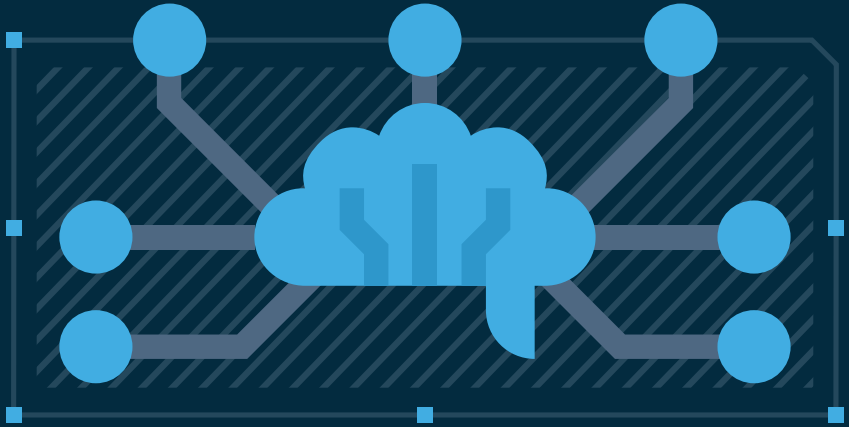
planners to understand the region that they are facing and improve the process to be more efficient. Second, AI has opened up the possibility of assessing public responses to city policies and regulations in real time. This possibility enabled city officers to promote public participation and make recommendations based on citizen's aspirations. AI helps public engagement by being more efficient through social listening and making a shared platform.<sup>20</sup>

The real example of AI-assisted planning is collaboration between the UP State Government to manage crowd management when the Kumbh Mela pilgrimage happens in India. This every 12 years rituals in India are attended by 200 million people. The analysis was conducted over 1,000 CCTV monitors across 3,200 hectares area. This collaboration utilised AI to analyse crowd behaviour and the government was able to predict the crowd and make an effective response to prevent chaos.<sup>21</sup>



<sup>20</sup> Leszczynski, A. "Sketsa Glitchy dari Platform Urbanisme." *Lingkungan dan Perencanaan D: Masyarakat dan Ruang* 38 (2): 189–208. 2019.

<sup>21</sup> "Kecerdasan Buatan Penghenti Nyata Kumbh Mela 2019." *India Hari Ini*, 14 Maret 2019. <https://www.indiatoday.in/india/story/kumbh-2019-mela-artificial-intelligence-record-1477774-2019-03-14>.



## 2 AI-Augmented Planning

The second function is AI as an augmenting partner in the urban planning process. This function focused on how AI has a pivotal role in analysing and obtaining data that is difficult to obtain manually. In this function, AI has a more prominent role with intermediate autonomy. AI helps to advance urban planning by identifying important patterns from big data, estimating and predicting the impact of urban planning, and providing objective feedback for continuous improvement.

The application of AI-augmented planning merely focused on simulating and evaluating different possibilities of urban planning. AI is being used as an interaction model between government, citizen behaviour, and local organisations to measure urban planning efforts.<sup>22</sup> In this function, AI is also used to integrate multiple scenarios of land use and lead to more effective and efficient spatial management. This initiative impacted more equitable and sustainable urban development.

<sup>22</sup> Han, Yu, dan Zhong-ren Peng. "Integrasi Pemerintah Daerah, Penduduk, dan Asuransi dalam Adaptasi Pesisir: Pendekatan Pemodelan Berbasis Agen." *Komputer, Lingkungan dan Sistem Perkotaan* 76 (Juli 2019): 69–79. <https://doi.org/10.1016/j.compenvurbsys.2019.04.001>.

The real example of AI-augmented planning is the collaboration between Andhra Pradesh's government and International Crop Research Institute for Semi-Arid Tropics (ICRISAT) and Microsoft to develop AI-based sowing apps for farmers in India. The apps utilise AI to analyse historical weather data, the best time for sowing, stages of farming, soil conditions, etc.<sup>23</sup> This app resulted in a 30% higher average yield per hectare.

### 3 AI-Automated Planning

The third function is AI as an automated partner in the urban planning process. In this function, AI already shows automation capability and strong self-learning to do several tasks including identifying hidden patterns from past data, proposing new scenarios, simulating and assessing the impact of upcoming schemes, and finalising urban plans. AI is more self-regulated in generating plans under urban planner's supervision. AI will be more intelligent through self-learning and exceeding them to handle complex situations, making scenarios out of uncertainties, involved in decision-making, until mitigating potential risks for specific urban problems. The planner's job changes from technical to more strategic such as defining problems, setting objectives, supervising AI in the planning process, until monitoring the output that has been generated.

The application of AI-Automated focused on how the urban planner can provide sufficient information and clear objectives to AI in order for them to self-work. Studies by Bao et al. (2017) show that a data-driven approach and flexible objective that integrated project goals and constraints help AI to develop construction plans.<sup>24</sup> Moreover, in some European countries such as Austria, Netherlands, Sweden, etc, the urban planners let the AI explore ideal models for

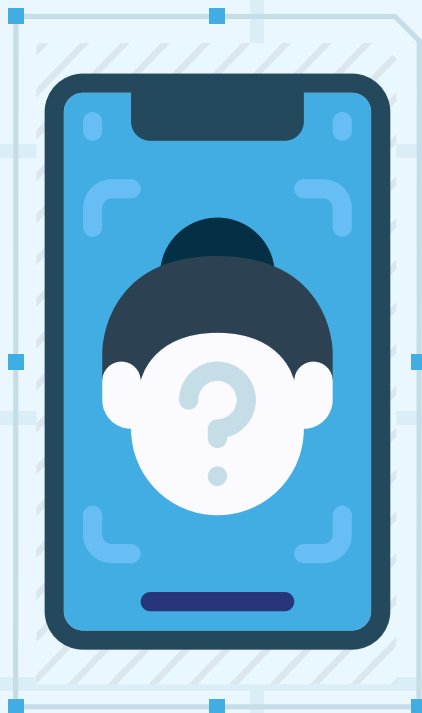
<sup>23</sup> Percontohan cloud cerdas Microsoft dan ICRISAT untuk pertanian ... Diakses pada 11 Maret 2024. <https://www.icrisat.org/microsoft-and-icrisats-intelligent-cloud-pilot-for-agriculture-in-andhra-pradesh-increase-hasil-tanaman-untuk-petani/>.

<sup>24</sup> Bao, J., T.He, S.Ruan, Y.Li, dan Y.Zheng. "Merencanakan Jalur Sepeda Berdasarkan Lintasan Berbagi Sepeda." Prosiding Konferensi Internasional ACM SIGKDD ke-23 tentang Penemuan Pengetahuan dan Penambangan Data, Asosiasi Mesin Komputasi, New York, NY, 2017. 1377–86. doi:10.1145/3097983.3098056.



urban governance by sustainable development through the urban living laboratories and usage of ChatGPT.<sup>25</sup>

A real example of AI-Automated planning is the Facial Recognition-based Attendance System for governance agencies. The utilisation of AI relies on the analysis of member's faces and contextualises it on an everyday basis.<sup>26</sup> The system has 99.5% accuracy and can save 45 minutes on average per day in taking attendance.



#### 4 AI-Autonomous Planning

The fourth function is AI as an autonomous partner in the urban planning process. In this function, AI demonstrates higher intelligence and tries to achieve full automation without human involvement. AI has a strong capability of making intelligent decisions based on data, utilising data and experience, and analysing it into problem-solving models that manifest into several decisions in urban issues.<sup>27</sup>

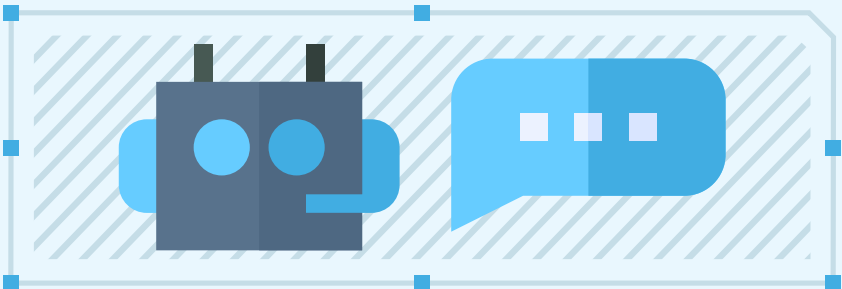
<sup>25</sup> Bulkeley, H., S. Marvin, Y. V. Palgan, K. McCormick, M. Breitfuss- Loidl, L. Mai, T. von Wirth, dan N. Frantzeskaki. "Laboratorium Kehidupan Perkotaan: Melaksanakan Kota Eksperimental?" Studi Perkotaan dan Regional Eropa 26 (4): 317–35. 2018 doi:10.1177/0969776418787222.

<sup>26</sup> TNeGA meluncurkan Sistem Pengenalan Wajah untuk kehadiran di dua Sekolah Chennai, TNeGA, <https://tnega.tn.gov.in/latestnews/297CloudcerdasMicrosoftdanICRISAT>

<sup>27</sup> Benbya, H., S. Pachidi, dan SL Jarvenpaa. "Editorial Edisi Khusus: Kecerdasan Buatan dalam Organisasi: Implikasinya terhadap Penelitian Sistem Informasi." Jurnal Asosiasi Sistem Informasi 22 (2): 281–303. 2021. doi:10.17705/1jais.00662.

With the full automation capability of AI, urban planners' roles have shifted as those who adjust, evaluate, maintain, and update the output by AI. Urban planners have a huge role as the ones who have the strategic knowledge and human touch. Urban planners have a pivotal part in directing and supervising the urban development process by AI, especially when the plan needs to be adjusted according to local and historical context. Besides that, urban planners are important to evaluate the output and contextualise it with the city's diversity, equity, and inclusivity problems. Last, urban planners are involved in maintaining AI and updating for further change if needed.<sup>28</sup>

The application of AI-Autonomous prediction will transform the urban planning landscape into more digital representations and generate more optimal planning schemes customised to more specific urban areas designation.<sup>29</sup> While AI is more strong and expected to perform at a similar level or better than actual urban planners, the human touch is still needed to align with real-world conditions and people's needs in the urban landscape. The role of urban planners is still needed because AI recommendations are not always the best scenario and need to be adapted according to specific needs.



<sup>28</sup> Wu, Z., X. Huang, D. Li, Z.-R. Peng, H. Long, L. Liu, Y. Li, dkk. 2018. "Simposium tentang 'Kecerdasan Buatan dan Dampaknya terhadap Perencanaan Kota.'" Forum Perencanaan Kota, 1-10. <https://kns.cnki.net/KCMS/detail/detail.aspx?dbcode=CJFD&filename=CXGH201805004> (Dalam Bahasa Cina).

<sup>29</sup> Norman, B. "Apakah Kota Otonom Masa Depan Perkotaan Kita?" Komunikasi Alam 9 (1): Pasal 2111. 2018 doi:10.1038/s41467-018-04505-0.

<sup>30</sup> Hebbar, Prajakta. "Chatbot Baru Telangana untuk Memfasilitasi Proses Pendaftaran di Negara Bagian." Majalah Analytics India, 2 Juni 2020.

The real example of AI-autonomous planning is the public service delivery that implements AI as chatbots that work on Robotic Process Automation (RPA). AI is utilised to analyse details such as location, fee for marriage, property registrations, etc. The public requests that are received are becoming input for fairly basic and routine reports. The reports are used by the chatbot again to improve the service to increase citizen experience.<sup>30</sup>

<sup>28</sup> Hebbar, Prajakta. "Chatbot Baru Telangana untuk Memfasilitasi Proses Pendaftaran di Negara Bagian." *Majalah Analytics India*, 2 Juni 2020.

## Envisioned AI for Urban Planning through Smart City in Indonesia: Progress & Challenge

According to the World Bank Report Realising Indonesia's Urban Potential, Indonesia is one of the countries with the fastest urbanisation growth and its been happening since 1980.<sup>31</sup> Data from the Indonesia Badan Pusat (BPS) shows that in 2020 the number of people living in the city will reach 57,3% Indonesian population.<sup>32</sup> The urbanisation trend leads to an increase in consumption, energy, natural resources, agriculture, etc. As the city grows, the problems become more complex and need smart solutions to solve it. Therefore, ICT usage becomes a key element to help manage the cities. For Indonesia, smart city and AI integration are defined as a way to manage city resources effectively and create sustainable solutions for improving lives.<sup>33</sup>

Many collective initiatives that Indonesia built for envisioning smart city and AI integration. First is the Garuda Smart City Framework created by Smart City and Community Innovation Center (SCCIC) Institute of Technology Bandung. This framework consists of a smart environment, smart society, and smart economy as an impact indicator to ensure cities in Indonesia implement smart cities.<sup>34</sup> Smart environment consists of how technology can utilize more efficient energy management from water, waste, and region. Smart economy focuses on how technology can scale up small business, creative, and other business related initiatives. Smart society consists of the initiative on how technology can elevate human resource quality from health, education, government, and many more. Second is the JAKI (Jakarta Kini), a super app platform provided by the

<sup>31</sup> Firman, T.. Pola demografi dan spasial urbanisasi terkini di Indonesia. *Populasi, Ruang dan Tempat*, 10(6), 421-434. 2004.

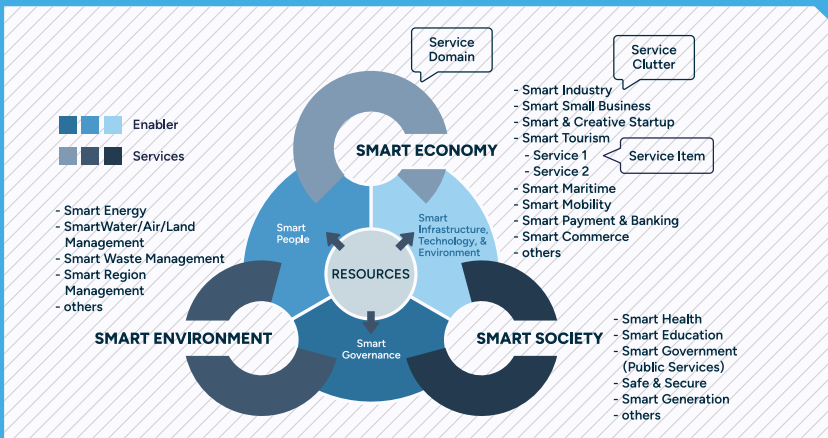
<sup>32</sup> Tempo.co. "Urbanisasi Dalam Gambar." *Interaktif*. Accessed March 11, 2024. <https://interaktif.tempo.co/proyek/urbanisasi-dalam-gambar>.

<sup>33</sup> Supangkat, Suhono, Arry Arman, Ryan Nugraha, and Yuti Fatimah. "The Implementation of Garuda Smart City Framework for Smart City Readiness Mapping in Indonesia." *Journal of Asia-Pacific Studies (Waseda University)*, March 10, 2018.

<sup>34</sup> Supangkat, Suhono, Arry Arman, Ryan Nugraha, and Yuti Fatimah. "The Implementation of Garuda Smart City Framework for Smart City Readiness Mapping in Indonesia." *Journal of Asia-Pacific Studies (Waseda University)*, March 10, 2018.

Government of Jakarta to encourage public participation for report and problem solving in the Jakarta area.<sup>35</sup> The system integrated in the Customer Relationship Management (CRM) system and utilised social media where every report that has been submitted will be handled quickly and recorded.

Figure 1. Garuda Smart City Framework Model



Source: The Implementation of Garuda Smart City Framework for Smart City Readiness Mapping in Indonesia.

Third is the Jambi City Operation Center (JCOC)<sup>36</sup>, a control room for monitoring services in Jambi City, Sumatra Region that uses AI. The system itself analyses and integrates information streamed by digital devices that are installed around the city. It connects with 15 applications to obtain data such as complaints, CCTV, civil services, emergency numbers, education, traffic control, health, etc. JCOC is also supported by the Electronic Traffic Law Environment to monitor and control traffic through CCTV. Through the JCOC control room called SIKOJA, it displays city information and keeps

<sup>35</sup> Kusumastuti, RD, dan J Rouli. "Implementasi Kota Cerdas dan Keterlibatan Masyarakat di Indonesia." Seri Konferensi IOP: Ilmu Bumi dan Lingkungan 940, no. 1 (1 Desember 2021): 012076. <https://doi.org/10.1088/1755-1315/940/1/012076>.

<sup>36</sup> Pratama, Irfandi, dan Suswanta Suswanta. "Kecerdasan Buatan dalam Mewujudkan Smart City melalui City Operation Center." Prosiding Konferensi Internasional Organisasi Publik, 2021.

track of public complaints. The application itself was released on 22 July 2019 and downloaded by more than 10.000 citizens gained a positive response from the people of Jambi City.



While there are some great initiatives in envisioning smart cities and AI integration, Indonesia still faces some challenges in envisioning the concept in Indonesia. First is the infrastructure challenge, where the supporting tools come with a high price and are difficult to obtain in one city.<sup>37</sup> The root cause is not all regions in Indonesia have adequate infrastructure to support the utilisation of ICT and AI. Data from BPS (2022) shows that the Indonesian disparities between regions of digital access will increase from 4,11% to 4,31% in 2021.<sup>38</sup>



The second challenge is the human resources to prepare society to accept the smart city implementation that is filled with digitalisation. The development of smart cities should include a social approach to make people understand how to utilise smart cities' features. The real example happens in Bandung, West Java area where Bandung's government has not been socialising and communicating the smart city usage to the citizens therefore many residents can not utilise it well.<sup>39</sup>

<sup>37</sup> Fikri, Haidar, Didik G Suharto, dan Rino Ardhan Nugroho. "Inovasi Pemerintah: Tantangan dan Praktik Terbaik Smart City di Indonesia." Prosiding Konferensi Internasional Penelitian Ilmu Komunikasi (ICCSR 2018), 2018. <https://doi.org/10.2991/iccsr-18.2018.32>.

<sup>38</sup> RI, Sekretariat Jenderal MPR. "Kesenjangan Digital Masih Tinggi, Wakil Ketua MPR: Perlunya Kolaborasi Dan Akselerasi Kinerja Digital." mpr.go.id. Accessed Feb 24, 2024. <https://www.mpr.go.id/berita/Kesenjangan-digital-masih-tinggi,-Wakil-ketua-MPR:-Perlunya-kolaborasi-dan-akselerasi-kinerja-digital>.

<sup>39</sup> Mursalin, Siti. "The Evaluation of Smart City Policy in Bandung City." Jurnal Ilmiah Ilmu Administrasi Publik: Jurnal Pemikiran dan Penelitian Administrasi Publik 2 (2021): 601–9.



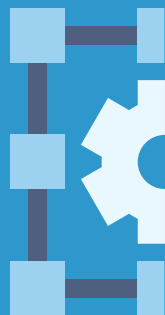
## → Concerns, Risks, and Solutions

The integration of AI and smart city initiatives oftentimes attracts some risk that lingers in the implementation process. First is discriminatory outputs from AI because of biased algorithms, non-representative data management, and distortion of data from the actual reality.<sup>40</sup> The algorithm part can create discrimination because the assumptions about the world that manifest into variables are influenced by developers' worldviews. Data from the United States Equal Employment Opportunity Commission (EEOC) stated that more than 83% of tech executives and managers are white people and just over 20% are women.<sup>41</sup> From this data, we can perceive that current algorithms have a risk of being prejudiced from one majority group themselves like gender, race, etc. The non-representative data happens because the bias that is created through algorithms influences the system to recognize some minority groups. This can lead to the distortion of data because AI is self-regulated and learns from the first brief that it received. When it comes to smart city and urban planning initiatives, the results have the possibility of being biased and tend to overlook one city population's group over another.

The second risk is cyber-security where AI systems can be manipulated and attacked by hackers. The attack varies from phishing, spying, malware, etc. In an urban planning context, citizens' sensitive data could be misused and be a danger for

<sup>40</sup> GIZ. "Kecerdasan Buatan dalam Pembangunan Perkotaan." Masyarakat Jerman untuk Kerja Sama Internasional (GIZ) GmbH, 2020.

<sup>41</sup> Johansen, Adrian. "Bagaimana Kurangnya Keberagaman dalam Teknologi Menyebabkan Bias Pengkodean dan Algoritma - Komentar Global." Komentar Global - Tempat dunia berpikir keras, 14 Juli 2022. <https://globalcomment.com/how-lack-of-diversity-in-tech-leads-to-coding-and-algorithm-biases/>.







the entire city. This cyberattack in smart city systems happens because of the lack of collaboration between government, industry, legal, and defence environments to tackle the issue.<sup>42</sup> Companies that provide ICT devices for smart cities mostly don't include cyber-security because the consumers are more concerned about affordability.<sup>43</sup>

The third risk is the digital divide, where the level of digitalisation between high-income and low-income regions differs from one another. Data shows in 2015, 89% of the city population had access to mobile connections while in the rural population, only 29% had it.<sup>44</sup> The digital divide is growing at a significantly faster rate in Indonesia's region, between the West and East Area. As a comparison, in South East Sulawesi in 2011 internet users only reached 11,63% of the household.<sup>45</sup> The divide manifests in some forms such as knowledge, infrastructure, and economic gap. The divide itself occurs because of the lack of access that some people can reach which makes it harder to integrate digital systems. Especially when AI solutions are developed in cities around the world, the gap between cities and rural areas becomes wider and impacts some groups being left behind.

AI can be a helpful tool for urban planning as long as the risks have been maintained and prevented. First, for the discriminatory algorithms, steps can be taken to ensure the system has clear specifications, putting safeguards in place, and being mindful to take local knowledge and implement it

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<sup>42</sup> Alam, Cuntur, dan Huda Ibrahim. "Strategi Keamanan Siber untuk Penerapan Kota Cerdas." *Arsip Internasional Ilmu Fotogrametri, Penginderaan Jauh dan Informasi Spasial* XLII (2019).

<sup>43</sup> Allen, N. Kelemahan Keamanan Siber Mengancam Membuat Kota Cerdas Lebih Mahal dan Berbahaya dibandingkan Pendahulunya, London School of Economics, London. 2016

<sup>44</sup> Komisi Broadband Keadaan Broadband: Broadband yang Mengkatalis Pembangunan Berkelanjutan. 2016

<sup>45</sup> Hidayat, Yayat. "Kesenjangan Digital Di Indonesia (Studi Kasus Di Kabupaten Wakatobi)." *Jurnal Pekomnas* 17 (2014).



into account. Both tech-ecosystem builders and the researcher must actively engage with marginalised communities to achieve equity and fairness in urban planning AI. Diversity in datasets and implementing bias detection can reduce the discrimination output possibilities. Tech actors also can provide education programs for AI users on how to navigate tools and create inclusive urban initiatives.<sup>46</sup>

Second, for cyber-security risks, the solution is to have clear boundaries where the data is stored by AI systems. Both tech actors and regulators should be subject to one belief that privacy is valued while at the same time being transparent on how AI collects the data. For big data management, developers should highlight encryption applications in order to reduce cyber-security risks.

Third, for the digital divide issue, the big solution is to shrink the gap through infrastructure development in rural areas. The effort of shrinking the gap can be achieved through actionable steps such as: revitalising social mobility, increasing long-term social programs for disadvantaged groups, cheaper digital technology, conducting easier digital technology design, and strengthening the regulations for inclusive smart cities.<sup>47</sup>



<sup>46</sup> Peng, Zhong-Ren, Kai-Fa Lu, Yanghe Liu, dan Wei Zhai. "Jalur AI Perencanaan Kota: Dari Dukungan Perencanaan hingga Pembuatan Rencana." *Jurnal Perencanaan Pendidikan dan Penelitian*, 22 Juni 2023. <https://doi.org/10.1177/0739456x231180568>.

<sup>47</sup> Dijk, Jan Van. *Menutup Kesenjangan Digital: Peran Teknologi Digital dalam Pembangunan Sosial, Kesejahteraan Semua Orang, dan Pendekatan Pandemi Covid-19*, n.d.

<sup>48</sup> Fikri, Haidar, Didik G Suharto, and Rino Ardhian Nugroho. "Government Innovation: The Challenges and the Best Practice of Smart City in Indonesia." *Proceedings of the International Conference of Communication Science Research (ICCSR 2018)*, 2018. <https://doi.org/10.2991/iccsr-18.2018.32>.

In the end, the efforts from academicians, profits or nonprofits groups, and other collective movement from grassroot to tackle the issue is not enough. These issues can be fastened to resolve by the efforts of the government and public policy stakeholders. The government can focus the development on providing basic infrastructure, improving economic media, developing the safety connection, improving social aspects, and providing a proper system that is integrated within the city.<sup>48</sup> For example in transportation the government can use the Intelligent Transport Management System (TMS) that focuses on sensor deployment for data collection.<sup>49</sup>

## → Conclusion

Cities are pivotal regions with its complexity in handling the population's diversity and socio-economic culture. Therefore the city needs innovative solutions that integrate ICT into the management. ICT with its advancement confines AI, a system that has the ability to independently learn, interpret, and use data to achieve specific goals and tasks through flexible adaptation. AI in urban planning served its function through assisted, augmented, automated, and autonomous processes.

In the implementation, the usage of AI in urban planning faces several challenges such as discriminatory outputs, cyber-security, and digital divide. Each challenge needs different solutions such as engaging with disadvantaged communities, being responsible on how AI stored and manages the data, and shrinking the gap by inclusive cities development.

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<sup>49</sup> B P, Ashwini, Savithramma R M, and R Sumathi. "Artificial Intelligence in Smart City Applications: An Overview." 2022 6th International Conference on Intelligent Computing and Control Systems (ICICCS), May 25, 2022. <https://doi.org/10.1109/iciccs53718.2022.9788152>.

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### Center for Digital Society

Faculty of Social and Political Sciences  
Universitas Gadjah Mada  
Building BC 2nd Floor, Room BC 201-203  
Jalan Socio Yustisia 1  
Bulaksumur, Yogyakarta, 55281, Indonesia

Phone : (0274) 563362, Ext. 116  
Email : [cfds.fisipol@ugm.ac.id](mailto:cfds.fisipol@ugm.ac.id)  
Website : [cfds.fisipol.ugm.ac.id](http://cfds.fisipol.ugm.ac.id)



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