Managing Artificial Intelligence on Public Transportation (Case Study Jakarta City, Indonesia)

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Abstract: This research aims to study AI management and its implementation in the public transportation sector to accommodate the needs of Jakarta's citizens. The basic framework used in this research is on analysis of case study transportation in Jakarta. Using a qualitative method with data collection from literature review and observation. Data analysis focuses on challenges and requirements needed to implement AI on public transportation to enhance urban mobility. Along with key AI management aspects discussed on 1) Source funding for AI in Mass Public Transport Project; 2) Reform Traditional Procurement Process; 3) Develop Unbiased AI; 4) Avoid the trap of over-relying on AI; 5) Develop Legal and Policy Framework. The purpose of this research is that it can contribute as a reference and recommendation for local government in making policy on AI and transportation in the future. Based on the research analysis, it is concluded that AI can address transportation problems in traffic management, traffic safety, public transportation, and urban mobility. However, AI implementation in Jakarta needs more improvement to ensure the system is integrated among many types of public transports, and improve its user-friendliness. It is recommended to develop a one-gate integrated application system to access all information on public transportation and to develop a legal and policy framework related to the applications.

1. Introduction

Based on the research, only 25% of Jakarta’s population uses public transportation, due to safety, comfort, and lack of regulation of private vehicle ownership. The lack of use of public transportation causes a domino effect to financial losses, as well as the overcapacity of road space that leads to congestion and traffic accidents. If the number of vehicle usage keeps increasing, it may cause a land-use change from green area to concrete or road, more fuel consumption, more emission, more pollution, and many environmental harms and health risks following it.

Jakarta is categorized as a transitioning city, which is a state where population growth is increasing significantly through urbanization that leads to many challenges in infrastructure. To overcome this, Jakarta is undergoing some milestones to become a smart city before 2025 covering 6 components of a smart city which are: smart living, smart mobility, smart governance, smart environment, smart economy, and smart people [1] One way to ensure its realization is by utilizing ICT effectively and efficiently. The more modern usage of ICT is known as Artificial Intelligence (AI).

Artificial Intelligence (AI) is a revolution in computer technology, by applying the intelligence of the human-like nervous system that enables decision making more effectively and efficiently. AI is programmed to receive information and acts according to a set of limitations with the given information. AI can perform reasoning with given data to predict outcomes and next events to create recommendations or suggestions. The founders of AI envisioned the notion of embedded intelligence as being conjoined between perception, reasoning, and actuation.

The use of AI in the public transportation sector is expected to improve services in terms of quality and quantity to minimize the use of private vehicles and reduce the potential for other losses. According to Frost & Sullivan, the transportation and logistics sector is expected to remain highly positive and will continue to expand for many years given President Joko Widodo’s continued focus on infrastructure development and the...
burgeoning e-commerce sector.

However, in Indonesia, the literature source explaining details of AI application in the transportation sector is not clear, this is the main background of the author’s research, the author would like to study existing usage of AI in the public transportation sector for Jakarta’s transportation, with main concerns on 1) What are the management aspects for applying AI in the public transportation sector; 2) How should be the design of AI implementation model for the public transportation sector in Jakarta. The purpose of this study is to analyze and recommend AI implementation models that are comfortable, convenient, effective, efficient, and wisely planned to support Jakarta’s people mobilization.

2. Theoretical Framework

2.1. Artificial Intelligence

Artificial Intelligence (AI) is an innovation in computer science that is very important in the present era and the future. Derived from the Latin "intelligo" which means "I understand", AI has the aim of understanding and taking action. The development of AI stems from the emergence of computers around the 1940s. At this time, attention is focused on the ability of computers to do something that can be done by humans [2] In this case, the computer can adapt the ability of human intelligence and behavior to solve problems. In late 1955, Newell and Simon developed The Logic Theorist, the first AI program.

During the 20th century, several definitions of Artificial Intelligence (AI) were proposed. One of the early definitions of AI, which is still popular, is "making computers think like humans", as shown by the large number of science fiction films promoting this view [3]. Also, Artificial Intelligence (AI) is a study of how to make computers do things which, at present, humans are better. Meanwhile, the field of artificial intelligence or AI is not only for understanding something but also for building intelligence entities. A system is called rational if the system is doing "the right thing", according to what it knows. A human-centered approach or a humane approach is part of empirical science, which involves observations and hypotheses about human behavior. The rationalist approach involves a combination of mathematics and engineering[4]. Some areas in AI according to [3] are Expert System, Computer Vision, Natural Language Processing (NLP), Robotics and Navigation Systems, Games, and Theorem Proving.

2.2 Smart City

Based on the research of Albino in 2015, the term Smart City was first used in the 1990s. At that time, it is to define new ICT applied concerning modern infrastructures within cities, how communities could become smart, and how a city could be designed to implement information technologies [5]. The aspect stressing that the diffusion of ICT in cities has to improve the way every subsystem operates, to enhance the quality of life. From the technology perspective, a smart city is a city with a great presence of ICT applied to critical infrastructure components and services. [7] To provide an overview of the state of the art sensors applications used for managing physical infrastructure digitally in a smart city. For example, energy sensors to maintain energy consumption, mobility sensors to improve traffic control schemes. [8] Regarding the dimensions of smart cities in their research, there are 6 components described: smart economy, smart mobility, a smart environment, smart people, smart living, and smart governance. Those dimensions with each aspect of urban life. The smart economy is related to the presence of industries in the field of ICT or employing ICT in production processes. Smart mobility refers to the use of ICT in modern transport technologies to improve urban traffic. Smart people related to the education...
aspect, smart governance related to e-democracy, smart environment associated with sustainability and efficiency, while smart living associated with security and quality.

Smart City can be defined simply as a smart city or smart city that can provide a better quality of life and comfort for its people. Smart City is considered as a city that humanizes its citizens. Smart City is a concept of planning, structuring, and managing a city that is integrated into all aspects of life. Smart City is a planning concept by utilizing technological developments that will make life easier and healthier with a high level of efficiency and effectiveness. There are several indicators or supporting factors in realizing a Smart City, specifically; Smart Economy, Smart Mobility, Smart Environment, Smart People, Smart Living, and Smart Governance [9]

3. Artificial Intelligence Condition on Public Transportation in Jakarta City

3.1. Type of Mass Public Transportation in Jakarta City

Going digital, KRL has launched a mobile application with implemented AI called KRL Access, this was the next generation after the Info KRL application. The new features offered by KRL Access make it easier for Commuter Line train service users, besides being able to find out the train's position and departure schedule. This application brings together all access to information from KCI social media into one platform. Through KRL Access, users can also register to get notifications directly to their cell phones when there is the latest information about KRL traffic conditions.

There is also a Commuter Vending Machine (C-VIM) present at the station so the user can define their itinerary. The presence of this vending machine is expected to meet the transaction needs of Commuter Line train service users, which are increasing day by day. Inside the train, there is also an information system plugged in and shows it on screen. This passenger information system includes information on KRL positions in real-time, KRL schedule information, and KRL route maps on a digital screen in the train series.

Transjakarta is the first Bus Rapid Transit (BRT) transportation system in South East and South Asia operating since 2004 in Jakarta, Indonesia. TransJakarta was designed as a mass transportation mode supporting the very dense capital activities. Since 2013, the ticket system has been changed to e-ticketing using a prepaid card issued by local cooperated banks. With the presence of IoT devices on Transjakarta buses, it can help companies break down the density and crowdedness of passengers on Transjakarta buses. Besides, the presence of technology on Transjakarta buses can also predict the age of the vehicle, thereby minimizing the damage to Transjakarta buses when operating on the highway. IoT implementation in Transjakarta can support the Jakarta Government in achieving integration between all the modes of transportations. The tracking devices installed in each mode of transportation will provide a pattern that can determine the time each vehicle converges into one.

Jakarta’s Mass Rapid Transit (MRT) is a rapid transit system in Jakarta, the capital city of Indonesia. The system is operated by PT MRT Jakarta. This transportation aims to redefine public transportation in the nation's capital by not only providing fast, efficient and on-time service but also by integrating front-end and back-end operations seamlessly. Information and situation of MRT can be accessed real-time, detailed operational information on MRT managers’ mobile phone about each activity at various stations.
Furthermore, the public can engage directly with the company through the mobile app with feedback and comments, helping the company to improve its services. Jakarta MRT is an example of an enterprise that is leveraging technology to become an intelligent enterprise that provides the best service possible to the Indonesian public even as it expands. Jakarta MRT runs on the SAP technology platform, SAP is helping many Indonesian transportation companies to grow while at the same time improving efficiency and lowering costs.

The LRT (Light Rail Transit) is designed with a floating crossing system so that it does not interfere with other modes of transportation. In addition, using Top Automachine 3 technology moves the train controlled by the control center so that the train can move without a physical driver in the train. The system smartly controls train movement, train speed, until time to stop, therefore LRT Jabodetabek can run without a train engineer. LRT is using moving block technology and Siemens AG software technology from Germany. With the system algorithm, idle time between the train can be reduced to around 2-3 minutes only. LRT movement used by the Jabodebek LRT is applying electric movement with power drawn from below (Lower Flow Electricity) using a third rail. The third rail is marked by the addition of a rail or conductor rail on the rail track.

The government is now utilizing ERP (Enterprise Resource Planning) software, further efficiency gains can be improved particularly when the city government implements the electronic road pricing system. By using data analytics and by having a good ERP process, the city administration may be able to better manage traffic flows especially in highly congested areas. Road users may pay higher rates during peak hours and lower rates during off-peak hours, which benefits them as well as the city as a whole. They also create greater transparency in terms of pricing and good governance. In further plan, it may result to predict status, and even influence travelers’ behavior and provide recommendations for transportations.

At this current moment, in developing Jakarta Smart City, the government has partnered with Indonesian AI firm Nodeflux, using its people-counting technology to analyze people’s movement in often crowded areas, such as a bus stop. Aside from data management, the company provides solutions such as computer vision and real-time video analysis, which help in the development of government policies in areas such as smart governance and smart mobility. It has collaborated with the Indonesian National Police to provide surveillance at high-profile international events, including the 2018 Asian Games and the 2018 International Monetary Fund and World Bank meeting. This is a new phase to start building AI communities in Indonesia, to create a government-supported program called AI Indonesia. Nodeflux technology in supporting the transportation sector in Jakarta covers functions: 1) License Plate Recognition: reads numbers and characters on license plates of any vehicle, even in bad weather, poor lighting, and even if the license plate has been modified; 2) People Counting: detects human traffic in a certain area. It can be used to count the number of people visiting the area and identify its peak hours; 3) Vehicle Counting: counts every passing vehicle and classifies them into motorcycles or small, medium, and large vehicles. It can classify up to 23 types of vehicle; 4) Vehicle Dwelling: identifies and calculates how long a vehicle stops at a certain spot. It can be used to monitor illegal parking and manage traffic; 5) Vehicle Intrusion: detects vehicles entering restricted areas, can be used to spot violations and send alerts.

3.2. Some Challenges on Managing AI in Public Transportation

High technology implementation with AI can bring advantages to the
business process aspect through enhancing effectiveness and efficiency. On the other side, technology investment needs huge capital and funding to computerized work units into one integrated system and enable them to give necessary information needed for decision making. To have an AI operated transportation system, we will need full support from the government, along with good cooperation with related private parties, banks, and also society.

To have such strong capital and cooperation, all parties including government, private sectors, SOE, and banks should be involved and build a Private Public Partnership (PPP) system for transportation management. It involves government and businesses that work together to complete a project and/or to provide services to the population. Many stimulus schemes from the government to SOE and banks in managing this PPP will encourage the acceleration of AI development in the transportation sector. Once an optimal service for the public has been created, the profits will come naturally, so that the large investment costs expended at the beginning will be covered.

To build and implement the use of artificial intelligence into an existing system, there will be much procurement of goods and services needed to establish it. With many parties involved, the procurement process will be a challenge. Procurement systems can be viewed as promoting good governance, therefore it will need reform. A good procurement system that features transparency, accountability and stakeholder participation can be a practical tool for carrying out effective governance reforms. Procurement reform is one of the government’s most effective tools for sustainable public sector reform. It is at the core of translating public policy into tangible results for citizens, delivering essential services, and implementing projects and programs. Furthermore, public procurement reform can contribute directly to improving a country’s business, investment, and social environments.

Good public procurement is a prerequisite for economic growth and effective public investment. Public procurement reform is an important tool for strengthening and supporting governance reforms and better public sector performance. Following the development of Jakarta Smart City or AI implementation, a modern and transparent procurement will give trust from the public to the government but also can support vendors as well as the government in procuring services and goods. Thus, every procurement need can be supported in real-time by the vendor, thereby increasing operation time and reducing lead time.

When procurement is handled properly, it will increase performance as well as productivity significantly. However, traditional procurement takes too much time, too much administration, too large indirect costs, silo works, and non-transparent. Procurement reform will also need to be supported with the use of high and updated technology, and also leadership role in creating better working culture. A good procurement system is needed to establish AI Indonesia, but AI itself can also be used in enhancing “smartness” into the procurement process but also by learning from data points to affect future outcomes. In particular, AI can enable three phases of the services procurement process by facilitating precise project scoping; enabling rapid matching of requirements to qualified service providers; selecting the best provider through streamlining proposal submission [10].

On its basis, AI is still only a processing machine. It depends on the intake of the data given to the system to propose a solution or recommendations. Same cases in AI usage in the transportation sector in Jakarta, in the usage of ERP software, for example, it can create greater transparency in terms of pricing and good governance. However, this outcome highly depends on the data given for the input of the AI itself; AI usually relies on big data and also upfront technology, but these two have
their risks. Invalid big data classification or junk data from customers/people can affect the accuracy of AI systems. Error level in the system can result in misleading information/recommendations given to the users. False information will surely lead to distrust for AI usage from the customers’ point of view. Those risks can be reduced by developing unbiased AI, these can be done by focusing and narrowing the business problems to be solved by the system, then structured and gathered trusted data that allows for different options, then design algorithms of data, test and deploy, and always monitor and look for feedback using real and latest data.

AI technology improves human life in many ways through simplification of routines and easier/more convenient experiences. However, AI can also act as a double-edged sword, as this can also bring harm to our life if people are too over-relying on it. The most visible one is data transparency. As AI feeds on data, this will lead to risks of privacy violations, discrimination, and even manipulation for political rights. Specifically, in the transportation sector, for instance, misleading information/modeling might cause accidents on the street, the user will be the part who will take justice punishment, not the AI.

AI can simplify jobs through automation, which can lead to less-human touch or interaction in the process, however, there is also an indirect risk from this phenomenon, which is the atrophy of skill. When humans come to rely on AI so much, they might become lazy even just to think and learn something new. As smart systems become involved more and more in someone’s decision-making areas, there will be a risk that important parts or decisions or events in our lives are being made without sufficient scrutiny. Another risk that is very common in using AI technology is the risk of technology downtime, which all users must be prepared with it.

Another challenge for Indonesia as a developing country is that our competitiveness level of its human resources is not high enough. Indonesia still lacks human resources (HR) in the field of artificial intelligence (Artificial Intelligence) both in quantity and quality. Currently, start-up companies still need a lot of experts in the fields of computer science and information systems, more specifically in artificial intelligence. To operate, manage and develop AI, specific jobs will be needed to enroll, such as experts on data scientists, information technology, math, etc. However, good talent in Indonesia who might have the capability of doing this business might already move to another developed country.

AI development may cause a positive impact on some parts of society, but may also harm others. The role of the government in maintaining the use of AI is highly important, for instance, to secure the data privacy of the users. The government along with related stakeholders needs to develop fair and square policy while also allowing technology acceleration and improvement. To formulate policy on AI implementation or AI policy framework, will need to consider:

| Ethics and Social Benefit | Organizations that develop, deploy or use AI systems and others must follow the AI Policy Framework. The national laws must require that such implementation objectives be identified and ensure that the objectives are consistent with the overall good ethical goals, as well as other principles of the AI Policy Framework |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Accountability           | In all instances, humans should remain accountable for the acts and omissions of AI systems.                                                                                                         |
Transparent and Informative

| Such use is transparent and that the decision outcomes of the AI system are explainable |

Fair and Non-Discrimination

| AI shall promote appropriate and effective measures to safeguard fairness in AI use. |

Secure and Reliable AI

| shall adopt design regimes and standards ensuring high safety and reliability of AI systems on one hand while limiting the exposure of developers and deployers on the other hand. |

The openness of Data and Fair Competition

| shall promote (a) open access to datasets that could be used in the development of AI systems and (b) open-source frameworks and software for AI systems. AI systems must be developed and deployed on a “compliance by design” basis concerning competition/antitrust law |

Confidentiality

| shall endeavor to ensure that AI systems are compliant with privacy norms and regulations, taking into account the unique characteristics of AI systems, and the evolution of standards on privacy |

Intellectual Property

| AI systems should take necessary steps to protect the rights in the resulting works through the appropriate and directed application of existing intellectual property rights laws. Governments should investigate how AI-authored works may be further protected. |

4. Conclusion

The market potential for AI in Jakarta’s transportations sector is sizable. A large economy and population bring with it big challenges, but also many opportunities for AI solutions. For the transportation sector, the challenge will be to leverage technology to manage growth. This means adopting machine learning technologies, artificial intelligence, and data analytics to drive business processes. This competitive advantage can be achieved with AI management in an efficient, targeted, and balanced manner.

The opportunity to develop AI in the DKI Jakarta transportation sector is still very large in terms of current development which is still limited to information on schedule and station density as well as electronic payments. There are still many opportunities for feature development and integration of customer data from various other aspects. Challenges in implementing AI itself are: 1) Source funding for AI in Mass Public Transport Project; 2) Reform Traditional Procurement Process; 3) Develop Unbiased AI; 4) Avoid the trap of over-relying on AI; 5) Talent who Master AI; 6) Develop Legal and Policy Framework.

The development of a smart city is closely related to government policy. It has to be coordinated and integrated to minimize egocentric from each interest. AI can address transportation problems in traffic management, traffic safety, public transportation, and urban mobility. However, AI implementation in Jakarta needs more improvement to ensure the system is integrated among many types of public transports, and improve its user-friendliness. Recommendation to develop a one-gate integrated application system to access all information of public transportation and to develop legal and policy framework related to the applications.

5. References

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