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Analysis of Odd-Even Policies in Overcoming Congestion and Air Pollution, Studies in Jakarta and Beijing

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ABSTRACT
This study examines the effectiveness of the Odd-Even policy in Jakarta from 2017 to 2022, comparing it with similar measures in Beijing from 2013 to 2017. Both megacities face severe traffic congestion due to rapid urbanization, population growth, and increased vehicle ownership. Jakarta's congestion is exacerbated by population density, inadequate public transportation, and high private vehicle ownership, leading to prolonged travel times, air pollution, and economic losses. Similarly, Beijing struggles with traffic congestion due to its massive population and rapid economic development, resulting in gridlock, air pollution, and decreased quality of life. The research aims to understand the Odd-Even policy's impact on traffic flow, emissions, and public perception in both cities, using qualitative methods and diverse data sources. It also identifies obstacles to policy effectiveness, such as enforcement, infrastructure, and public compliance, offering recommendations for policymakers and urban planners to improve sustainable transportation and environmental management. Overall, the study contributes insights into congestion mitigation in megacities, aiding policymakers in enhancing urban life quality.
Keywords: Odd-Even Policy, Traffic, Air Pollution.

INTRODUCTION

The capital has acquired an inherent identity due to the concurrent rise in population and the usage of both two-wheeled and four-wheeled vehicles. This problem has had a persistent and significant impact due to its exacerbation of daily traffic congestion. The main roadways have become inundated with traffic, particularly during peak hours, resulting in highway congestion. Consequently, journeys that are supposed to be brief take longer than anticipated, causing individuals to spend hours in their vehicles merely to traverse distances that should be covered swiftly. In addition, congestion significantly increases air pollution, resulting in adverse effects on public health and economic productivity. Evidence indicates that there is a significant correlation between the rising number of motorized vehicles and the substantial growth in exhaust emissions produced by these vehicles. Elevated fuel

consumption and emissions have a detrimental impact on air quality, hence posing risks to both human health and the environment. In 2015, it was anticipated that 3.7 million individuals would die prematurely due to poor outdoor air quality, also known as ambient air pollution, in both urban and rural regions (Kumar Pathak, Sood, Singh, & Channiwala, 2016). These findings indicate that the emissions of gases generated by vehicles can have a detrimental effect on human health on a worldwide scale.

The community's environment can be impacted by exposure to air pollution, particularly in metropolitan regions that are densely populated and have high concentrations of emissions. The primary source of air pollution exposure typically arises from commuting or traveling in urban environments. Specifically, the presence of micro-transportation utilized in daily activities makes a noteworthy impact (Von Schneidemesser et al., 2019). The surge in urban population has led to a substantial escalation in the already substantial utilization of energy and other resources, hence exacerbating air pollution and other associated issues. The air pollution emitted by major urban areas contains significant concentrations of criterion pollutants such as particulate matter, sulfur dioxide (SO2), and nitrogen oxides (NOx), as well as greenhouse gases, ozone precursors, and aerosols. These pollutants have the potential to impact the environment not only at a local level but also on a regional and global scale (Gurjar, 2016). According to an environmental study, the primary source of air pollution in this city is transportation emissions, particularly from private vehicles. In Indonesia, the primary source of air pollution is the emission of exhaust gases from motorized vehicles, which account for 70% to 80% of the total, while industrial activities contribute only 20% to 30% (Dewi, 2022). In contrast to other metropolitan areas, where the bulk of individuals rely on public transportation for their daily endeavors. According to (Sitanggang & Saribanon, 2018), the majority of Jakarta residents have a preference for using private vehicles over public transportation.

Conversely, the rise in population density also exerts pressure on road infrastructure, leading to increased burdens. Overcrowding on roads has led to an increased risk of accidents and a decrease in the efficiency of both public and private transportation, despite their initial capacity to handle a specific number of cars. The escalating population density in the capital, particularly in Jakarta, has emerged as a pressing worry due to the ongoing rise in transmigration data. Based on the 2023 data release, the rate of transmigration to Jakarta exhibits consistent annual growth (Javier, 2021). This phenomenon not only demonstrates a substantial influx of inhabitants to metropolitan areas in pursuit of economic prospects and an improved quality of life, but also substantially exacerbates the issue of traffic congestion. The rise in transmigration to Jakarta has a direct impact on the volume of vehicles on the road as well as the increased mobility of the city's inhabitants. The impact is directly experienced through the escalation of traffic density, particularly during peak hours. Short travel durations are extended, leading to reduced efficiency and heightened operational expenses for both individuals and businesses.

Similarly, various capital cities across the globe have resorted to implementing odd-even policies to combat the persistent challenges of traffic congestion and air pollution. The trajectory of development experienced by Beijing, being the capital of China, significantly contributes to the proliferation of private vehicles over the years. This steady increase in vehicular traffic inundates the city streets on a daily basis, exacerbating traffic gridlocks and exacerbating the already dire air quality. The introduction of the odd-even system emerges as yet another strategic initiative by the Beijing municipal government to tackle the escalating traffic congestion issues that emerged during the Beijing Summer Olympics. As the host city, the government bears a palpable obligation to proactively address these concerns to ensure the smooth functioning of the city for both athletes and visitors alike (Ruimin Li & Guo, 2016).

Beyond traffic congestion, another pressing concern motivating the adoption of the odd-even policy in Beijing is air pollution. However, apprehensions persist regarding the efficacy of this policy in effectively mitigating the persistent air quality challenges facing the city. The unchecked emissions from motor vehicles continue to take a toll on Beijing's atmospheric quality, perpetuating a cycle of environmental degradation (Yunyan Li, Huang, Yin, Sun, & Ge, 2020). Despite the implementation of such measures, the underlying issue of vehicular emissions poses a formidable challenge to achieving tangible improvements in air quality. Thus, while the odd-even policy represents a step towards addressing the multifaceted challenges of traffic congestion and air pollution, sustained efforts and comprehensive strategies are imperative to effecting lasting change in Beijing's urban landscape.

Therefore, this study seeks to address this deficiency by conducting a comparative analysis of the outcomes of the Odd-Even policy's implementation in Jakarta under the Jakarta government period of 2017-2022 and a similar policy's implementation in Beijing 2013 - 2017. The identified research problem is the assessment of the effectiveness of the Odd-Even policy implementation in Jakarta during the period of 2017-2022 administration, particularly in mitigating traffic congestion issues. The objective of this study is to conduct a comparative analysis of the outcomes of adopting the Odd-Even policy in Jakarta and Beijing, while also identifying the determinants that contribute to the policy's effectiveness or ineffectiveness in both urban areas. The research focuses on comparing Jakarta and Beijing, two major cities facing considerable traffic congestion issues. It also examines the impact of the Odd-Even strategy on traffic and environmental conditions in these cities.

The study will provide a detailed overview of the literature review pertaining to urban transportation policy, with a specific focus on the Odd-Even strategies used in Jakarta and Beijing. Subsequently, this paper will examine the research methodology employed, encompassing the approach and analytical tools utilized to compare the efficacy of applying the Odd-Even policy in the two cities. Subsequently, this article will elucidate the findings of the research, encompassing a juxtapositional examination between Jakarta and Beijing and the determinants that exert influence on the efficacy or inefficacy of the Odd-Even policy in

each metropolis. In conclusion, this essay will provide definitive findings and suggestions for forthcoming strategies for addressing the issue of traffic congestion in Jakarta and Beijing.

RESEARCH METHODS

This research is qualitative research that prioritizes library materials (library research). In this case, the author tries to produce descriptive and interpretive data. In accordance with Jane Richie's meaning, research that seeks to present the social world and its perspectives in terms of concepts, behavior and perceptions is a characteristic of qualitative research (Nasution, 2023a). So the use of qualitative methods is useful for research that starts from the phenomenological paradigm whose objectivity is built on the formulation of certain situations as lived by certain individuals or social groups and is relevant to the research objectives. Thus, the process used is induction in nature, so it does not depend on the existence of theory or hypothesis, because in qualitative research, both function to understand or interpret categorized data. This approach was chosen because there is a belief that the nature of document text is dual. Namely, it is objective and subjective or has explicit (phenomenon) and implied (nomenon) nuances (Nasution, 2023b).

Specifically, this research uses the synthetic analysis method to help examine critically, through terms or definitions that have been put forward previously by figures or thinkers, so that the strengths and weaknesses of each can be identified and then find a new definition or meaning that is more precise and complete. The data collection used in this research is scientific journals published from 2014 to 2023 and news articles from national and international sources that discuss the impact of the odd-even policy. So, the combination of these two sources allows researchers to gain a comprehensive understanding of the research topic. Through scientific journals, researchers can access academic views and the latest empirical findings that are relevant to odd-even policies. Meanwhile, through news articles, researchers can gain an understanding of the implementation of this policy in various social contexts.

In the process of presenting data, researchers apply a synthesis approach, where various information from scientific journals is compiled and analyzed systematically. Data from these scientific journals consists of research results, literature reviews, and policy analysis conducted by leading academics and researchers. Researchers sort through relevant information and identify general patterns and differences between existing views and findings. Apart from that, data was also collected through news articles discussing odd-even policies, both from a national and international perspective. News articles provide insight into the implementation of odd-even policies in a broader social and political context. Data from news articles is used to complement and enrich researchers' understanding of the impact of these policies on people's daily lives as well as the public's response to these policies.

After the data was collected, researchers carried out a holistic and in-depth analysis. Data from scientific journals and news articles were synthesized to produce a comprehensive

understanding of the implementation of the odd-even policy in Jakarta and Beijing. Researchers examined various points of view, challenges, opportunities, and the impact of these policies in overcoming congestion and air pollution in the two cities. The analysis results obtained from presenting this data are the basis for researchers to develop a deeper understanding of the odd-even policy. In addition, the data presented also significantly contributes to the development of theory and practice in the public and environmental policy field. Thus, the presentation of data in this research not only provides a comprehensive picture of odd-even policies but also provides a basis for developing more effective policies in overcoming the problems of congestion and air pollution in urban areas.

RESULTS AND DISCUSSION

The adoption of the Odd-Even policy in China, particularly in Beijing, demonstrates a significant dedication from the government to address two primary challenges encountered by numerous major cities globally, namely traffic congestion and air pollution. Over the past three decades, Chinese cities, including Beijing, have seen the adverse effects of a significant rise in motorized cars on the roads, which may be attributed to rapid economic growth and urbanization (Yang, Purevjav, & Li, 2020). In Beijing, motor vehicle emissions account for up to 31.1% of air pollution, indicating a substantial role of the transportation sector in China's capital city's air pollution issue. The government must promptly implement measures to mitigate vehicle exhaust emissions and enhance air quality in this densely populated urban area. One way to overcome this problem is by implementing several policies, such as the Odd-Even system rules. Despite the numerous challenges and temporary nature of implementing the Odd-Even system in Beijing, the local government persists in enforcing this policy in various circumstances. In fact, a study conducted in China over a period of approximately 2 years indicates that this measure has effectively reduced vehicle emissions by 40% (Xing yuan Liu, Xu, Wu, & Wen, 2023). This demonstrates that the regulations and policies implemented by the government have an impact on the air quality in Beijing.

Beijing's emission reductions are not implemented without purpose; the city's transportation system is strictly regulated by the government to reduce the level of pollution caused by motorized vehicles. This demonstrates the serious efforts of the Beijing government in addressing air pollution issues that impact the health and quality of life of city residents. A tightly regulated transportation system serves as the foundation for various policies aimed at reducing exhaust emissions and improving air quality in the city. For instance, in October 2013, Beijing launched a work program titled "Motor Vehicle Emission Pollution Control 2013-2017," which underscored the importance of utilizing public transportation to conserve energy and maintain smooth traffic flow (Sun et al., 2021). This initiative is expected to play a significant role in curbing gas emissions in Beijing. Moreover, it is anticipated to incentivize the government to further enhance public transport infrastructure, including the integration of electric buses and alternative energy vehicles. Additionally, travel rights and ownership restrictions are enforced by the government as part

of Beijing's regulations regarding the Odd-Even system. This endeavor also reflects the public's and government's awareness of the crucial importance of environmental sustainability amidst rapid urbanization. Beijing, as one of the largest metropolitan cities globally, recognizes that air pollution and exhaust emissions are issues that cannot be overlooked.

The implementation of the Odd-Even policy in Beijing has a profound impact on both the degree of traffic congestion and air pollution, as well as inducing substantial modifications in people's behavior. Mandates for the utilization of personal automobiles on specific days have compelled individuals to modify their routines in terms of daily mobility. The majority of Beijing inhabitants have commenced seeking alternative means of mobility, such as utilizing public transit, cycling, or walking, in order to overcome the limitations imposed on the usage of private vehicles. This phenomenon has a significant impact on both individual mobility and the overall daily travel patterns and transportation habits of society. The changes in mobility experienced by the community with the Odd-Even system in Beijing are undoubtedly a crucial part of the necessity for a more sustainable planning and management process for the city's transportation sector. The development of efficient public transportation mobility plans continues to be carried out by the Beijing government for the sake of sustainable living. Several research studies indicate that the transportation problems experienced by Beijing can be addressed by implementing various policies that play pivotal roles in the development and survival of urban society (Xu, Grant-Muller, Huang, & Gao, 2015). Beijing's Odd-Even System has brought about significant changes in people's travel patterns, driving a transformation towards more efficient and sustainable mobility. These changes not only address the practical need to tackle traffic congestion but also align with a broader vision to create a more environmentally friendly and sustainable city as a whole. By limiting the use of private vehicles, this system encourages the utilization of public transportation and other alternatives, consistent with sustainable development principles that emphasize the reduction of gas emissions and the protection of the environment.

Beijing's inhabitants' daily travel patterns are influenced by changes in their routines. The implementation of regulations limiting the utilization of personal automobiles on specific days has prompted individuals to meticulously prepare and coordinate their journeys. Many individuals have started to optimize their travel by utilizing private vehicles on authorized days, while on alternate days they transition to public transportation or walking. The transportation network, which is a crucial component of urban life and serves as a prerequisite for the prosperity of its residents (Bai & Krumdieck, 2020; Xu et al., 2015), highlights the Beijing government's proactive approach in enhancing public transportation infrastructure to be more efficient and extensive. These initiatives not only aid in mitigating air pollution but also facilitate easier transportation access for all segments of society, particularly in areas that were previously underserved. Consequently, the implementation of the Odd-Even regulation has impacted individuals' daily mobility patterns and compelled them to exhibit greater adherence to organizing their journeys.

In addition, the introduction of the Odd-Even policy has also altered the social contact patterns of Beijing society. The imposition of limitations on the utilization of personal automobiles has diminished the extent of personal mobility in accessing workplaces, educational institutions, and social hubs. This social transformation highlights the significance of transportation policies in shaping behavioral patterns and impacting local community dynamics. Local residents have also chosen for public transportation or canceled their out-of-town trips in response to the Odd-Even policy regulations (Yang, 2018). This phenomenon has had an impact on the way people engage socially, leading to a greater emphasis on their immediate surroundings and a decrease in interactions that span across other regions. Consequently, this program has fostered greater local connections and enhanced unity among urban inhabitants. Similarly, these changes have also spurred the growth of the bicycle and public transportation industries in this city, while also fostering innovation in the development of environmentally friendly transportation infrastructure. So, this naturally also has implications for the well-being of the populace.

Moreover, the implementation of the odd-even regulation resulted in a quite significant decrease in air pollution levels. The data analysis reveals a substantial reduction in the concentrations of PM2.5 (fine particles) and NO2 (nitrogen dioxide) during the implementation of this program (Yunyan Li et al., 2020). Other research also suggests that restrictions on private vehicles contribute to the improvement of air quality in Beijing to a certain extent (Zhang, 2020). The odd-even policy and other programs not only effectively mitigate air pollution but also significantly improve public health. Lowering air pollution levels is directly correlated with enhancing respiratory health and decreasing the prevalence of air pollution-related diseases. Health concerns are a top priority for the Beijing government in ensuring the well-being of its citizens. Research findings have shown that the restrictions imposed by the Beijing government have led to a reduction in the number of patients suffering from respiratory diseases in hospitals (Yunxia Liu, Hong, & Liu, 2016). This clearly demonstrates the impact that the odd-even system, implemented by the government, has on the health of the population.

Despite the Odd-Even policy's impact on Beijing society, persistent hurdles and paradoxes continue to plague its implementation. Nevertheless, it is crucial to acknowledge that every policy undeniably entails repercussions and issues that necessitate addressing. An evident barrier arises from individuals' perceptions and reactions towards limitations imposed on their own automobiles. These limits can be problematic and restrict the mobility of individuals, particularly for those accustomed to unrestricted car usage. A quantitative analysis also indicated that the policy's impact on vehicle restrictions resulted in rapid motorization, causing inadequacy in the collection and analysis of transportation data due to existing budget limitations. Additionally, several studies have explained that the government-imposed restrictions were not well-received by some commuters, and some individuals also perceived the inefficiency of these restriction policies (Zhiyong Liu, Li, Wang, & Shang, 2018). Furthermore, there are those who have challenges when transitioning to other forms of

transportation. For instance, certain people may lack familiarity with utilizing public transportation or cycling, and the process of adjusting to this can require a significant amount of time and effort.

Furthermore, people from diverse socioeconomic backgrounds may also encounter challenges. Individuals residing in suburban regions or lacking sufficient access to public transportation infrastructure may face more significant challenges in adhering to the Odd-Even guideline. Obstacles such as extended travel distances, insufficient coverage of public transportation routes in their area, or increased expenses related to using alternative transportation might pose significant challenges for them. According to research findings, a significant number of individuals still hold objections and are unwilling to pay additional fees for utilizing public transportation, despite the potential benefit of avoiding traffic congestion (Wang, 2014). It became evident that these measures were met with resistance from certain commuters. Some individuals expressed dissatisfaction with the limitations imposed on their mobility and the inconvenience caused by the restrictions. This discontent among segments of the population highlighted the need for policymakers to carefully consider the implications of such policies on the daily lives and routines of citizens. Moreover, concerns were raised regarding the overall efficacy of these restriction policies. While they aimed to address issues such as traffic congestion and air pollution, their effectiveness came into question. Some individuals perceived the policies as ineffective in achieving their intended objectives, raising doubts about their long-term sustainability and impact on the transportation system. This poses a significant challenge for the Beijing government, which must be promptly addressed to ensure that people can comfortably utilize public transportation without feeling burdened by costs.

Concurrently, Jakarta, renowned as a hub for economic and commercial endeavors, entices a significant influx of individuals who relocate to the city in pursuit of employment prospects and to enhance their quality of life (Indraprahasta & Derudder, 2019). Consequently, this results in a swift increase in population and a substantial need for transportation. The prioritization of ease and comfort in one's lifestyle sometimes fosters a reliance on private modes of transportation, such as cars or motorbikes, for everyday tasks. This behavior directly leads to the proliferation of vehicles on the road and exacerbates traffic congestion (Said & Maryam, 2020). In addition, the public transportation system in Jakarta was formerly insufficiently integrated to meet the high mobility demands of the community. Conversely, inadequate service and dissatisfaction experienced by public transportation users, such as delays, ambiguous information, inadequate security, or substandard infrastructure, lead individuals to evaluate and favor private transportation options (Joewono, Tarigan, & Susilo, 2016). The public transportation infrastructure in Jakarta, including buses, municipal transportation, and trains, has failed to offer a viable substitute for private vehicles. Consequently, a significant number of individuals still depend on personal automobiles for their daily tasks, leading to heightened traffic congestion on the roadways. Under the Jakarta government (2017-2022), efforts to enhance the quality of public

transportation persisted, aiming to ensure safety and comfort for Jakarta's residents through innovative initiatives and program development (Muksin, Rofik, & Karim, 2024). However, despite these endeavors, the implementation of such measures remains a subject of debate among local residents.

Aside from internal causes like inadequate infrastructure and shortcomings in urban planning, external factors such as transmigration and high population density play a crucial role in the ongoing problem of traffic congestion in Jakarta. The issue of transmigration, which involves people migrating from other parts of Indonesia to Jakarta in search of better job prospects and a higher quality of life, exacerbates the pressure on the city's transportation infrastructure. The flood of migrants, motivated by the attractiveness of Jakarta's economic opportunities, worsens the disparity between population growth and the development of transportation infrastructure, thus heightening traffic congestion on the city's roads. This will undoubtedly prompt the majority of individuals, either directly or indirectly, to acquire and opt for private transportation to conduct their daily routines, thus abstaining from utilizing public transportation (Perwitasaria, Setyowatib, & Handayanic, 2021). This trend mirrors shifts in societal behavior, wherein there's a preference for the comfort and flexibility offered by private vehicles.

With their own vehicles, individuals can tailor their travel schedules to suit their personal needs and preferences, eliminating the need to adhere to fixed schedules and routes stipulated by public transportation services. Furthermore, considerations such as privacy and security weigh heavily on the decision-making process for many individuals when it comes to utilizing private transportation. However, the surge in private vehicles is also bound to pose challenges for Jakarta. Furthermore, the reliance on private transportation perpetuates a cycle of car-centric urban development, wherein infrastructure investments prioritize roads and highways over public transit systems and pedestrian-friendly initiatives. This further marginalizes those who rely on public transportation and active modes of transportation, exacerbating issues of social equity and access to mobility.

The problem of high population density is especially severe in the urban areas of Jakarta, where a large number of residents puts pressure on the limited road space and obstructs the growth of transportation networks. The resulting congestion not only hinders the smooth movement of vehicles but also presents substantial obstacles for urban transportation and accessibility. The rise in vehicle volume persists alongside the population growth in the Jakarta area. Undoubtedly, this will pose a challenge for Jakarta. Additionally, the restrictions imposed by the Jakarta government have prompted individuals from the upper middle class to seek alternative methods to circumvent the odd-even policy. They achieve this by acquiring supplementary vehicles and requesting distinct license plate numbers for each vehicle. Consequently, an increasing number of individuals now possess multiple private cars, with the intention of reducing reliance on public transportation. However, for those unable to afford an extra vehicle, resorting to falsifying license plate

numbers becomes a common strategy to ensure daily vehicle usage, despite the awareness that such actions contravene existing regulations (Rahadian, Saputra, & Ramadhanty, 2022).

Moreover, the implementation of these strategies may have broader implications for Jakarta's urban landscape. The rise in the number of private vehicles due to the odd-even policy restrictions could exacerbate existing challenges such as traffic congestion and air pollution. With more cars on the road, traffic flow could become even more sluggish, leading to increased travel times and frustration for commuters. Furthermore, the increased prevalence of private vehicles may lead to greater strain on the city's infrastructure, including roads and parking facilities. Over time, this could necessitate further investment in transportation infrastructure to accommodate the growing number of vehicles, potentially diverting resources from other essential services and projects.

Under the administration of Jakarta from 2017 to 2022, it adopted the odd-even policy in Jakarta as a progressive solution to address the issue of traffic bottlenecks and congestion. In addition to the difficulties encountered in executing the odd-even policy, Jakarta has also introduced the Jaklingko program as a prominent measure to mitigate the issues of overcrowding and pollution. The primary objective of this program was to facilitate the integration of public transportations in the entire Jakarta area, ensuring its accessibility to individuals from all strata of society. Later, this system will connect several transportation access points in Jakarta, where, with one initial payment, people can use the integrated transportation services offered in the program (Handayani, Afrianti, & Suryandari, 2021). Jaklingko mostly comprises land transportation, specifically referred to as the "Transjakarta Bus." Currently, the Transjakarta buses serve as the primary foundation of Jakarta's public transit system. The objective of this program is to offer cost-effective and convenient transportation services for the residents of Jakarta. Under the direction of the Jakarta government for the period 2017-2022, the Jaklingko program was enhanced through the implementation of numerous innovative and improved measures. One of the initiatives is enhancing the quality and accessibility of the Transjakarta Bus fleet. The Jakarta government increased the Transjakarta route network and enhanced the frequency of bus services to guarantee the provision of sufficient transportation for the inhabitants of Jakarta. Indeed, the integration of public transportation in Jakarta significantly assists the local community in attaining transportation accessibility to facilitate their daily activities.

The objective of this measure is to diminish individuals' reliance on personal automobiles and promote the utilization of public transportation as a more environmentally friendly option. In addition to that, Jakarta implemented many initiatives to enhance the quality of Transjakarta bus services. The implementation of more contemporary bus stations was undertaken to enhance the convenience of public transportation patrons. Technology has been implemented in Transjakarta Bus operations, including the utilization of software to monitor bus timetables and routes in real-time. Furthermore, additional lanes are also being constructed to expand the coverage of Transjakarta transportation. The objective is to enhance the travel experience for individuals utilizing public transit. The Jakarta government

(2017-2022) is also constructing road infrastructure to facilitate the implementation of the Jaklingko initiative. Enhancements were implemented on bicycle lanes and sidewalks to promote the utilization of non-motorized transportation and enhance pedestrian safety. This measure aligns with Jakarta government for the period 2017-2022 objective to establish a city that is more ecologically conscious and enduring.

Apart from that, city transportation or commonly referred to as Angkot, serves as another alternative and is also crucial for the community, alongside Transjakarta buses, for daily mobility. The use of public transportation in people's lives has been ongoing for a long time, making it a reliable mode of transportation due to its easier access and wider accessibility. It can reach remote areas that are not accessible by Transjakarta buses. Moreover, the cost is affordable, making it a preferred option for lower-middle-class individuals (Rachman, Nooraeni, & Yuliana, 2021). With its extensive usage in the community, the Jakarta government continues to strive to enhance public transportation facilities to ensure passenger comfort. This includes introducing city transportation (angkot) equipped with CCTV and air conditioning for passenger comfort (Tambunan, Masengi, & Dilapanga, 2024). The Jakarta government hopes that the public will find using public transportation more comfortable, leading them to prefer it over private vehicles. This, in turn, is expected to reduce congestion as the usage of private vehicles decreases.

Hence, the surge in Transjakarta commuters, corresponding to the influx of people migrating to Jakarta, exerts a substantial influence on the extent of traffic congestion in the metropolis. The utilization of public transportation by a larger population alleviates strain on the road infrastructure, but the influx of individuals relocating to Jakarta tends to amplify the number of vehicles on the road, thereby exacerbating traffic congestion. The scholarly research undertaken by (Indraprahasta & Derudder, 2019) emphasizes the connection between population density and traffic congestion. This highlights the urgent need for policymakers to tackle this complex problem by implementing comprehensive urban planning and sustainable transportation policies. The Jakarta administration has implemented several initiatives to address the increasing traffic congestion crisis. These policies aim to decrease dependence on private vehicles and encourage the adoption of alternative forms of travel. One of the notable strategies among these projects is the odd-even policy, which regulates the utilization of private vehicles based on the numerical sequence of license plate numbers. The odd-even policy, initially implemented as a daily rotation plan, was later modified by the Jakarta government for the period 2017-2022. It transformed into a monthly alternating system to provide more flexibility and reduce the daily inconveniences faced by commuters. The implementation of a monthly odd-even rotation system signifies a deliberate shift from the previous daily arrangement, aimed at offering commuters additional choices while effectively addressing traffic congestion.

Therefore, Beijing serves as a prime illustration of a nation that has effectively enforced an odd-even policy in densely populated urban areas. The policies implemented there share similar objectives with Jakarta, specifically addressing the growing issues of traffic congestion

and air pollution. However, the primary distinction between the two is that Beijing typically enforces an odd-even policy exclusively during peak traffic hours. While Jakarta decides to implement this policy throughout the day, specifically just targeting civilian vehicles, some cities in Beijing adopt a more comprehensive approach by paying attention to all elements of civil affairs and government when executing this policy, where both society and government participate in the established system rules. Furthermore, another distinction can be found in the realm of policy implementation. Certain cities in Beijing may impose broader or more precise territorial limitations in comparison to Jakarta. This phenomenon can be attributed to the expansive urban size and dense population in many Chinese cities. The positive impact offered by this system is not only focused on alleviating traffic congestion but also on addressing other issues. For instance, in Beijing, the Odd-Even system implementation not only includes restricting private vehicles based on their license plates or limiting private vehicle ownership but also imposes restrictions and prohibitions on trucks or vehicles carrying chemicals, mud, or stones for transportation purposes from traversing the streets of Beijing on certain days during the program's implementation (Wen et al., 2016). Furthermore, the Chinese government also halted 30% of government-owned vehicles to adhere to the set restrictions (Adam Y. Liu, Oi, & Zhang, 2022). The addition of regulations, such as stopping a number of government-owned vehicles carried out by China, has actually also succeeded in helping the Odd-Even system run as it should.

In addition, the Chinese government is facilitating the expansion of public transportation by raising the number of buses from 21,000 to 25,000 and extending the operation hours of the subway (Yu, Li, Sun, & Taghizadeh-Hesary, 2021). The inclusion of transportation facilities demonstrates the Chinese government's commitment to addressing issues and supporting the implementation of the Odd-Even policy. Increasing the number of buses will also expand the coverage of public transportation services in various regions, particularly in areas that were previously underserved. This will improve people's access to public transportation, thereby reducing their reliance on private vehicles. Furthermore, by extending the operating hours of the subway, the government can offer more flexible transportation options for individuals who work or engage in activities outside regular working hours. The expansion of public transportation not only yields direct benefits in reducing congestion and air pollution but also brings about positive social and welfare impacts both directly and indirectly. With improved access to public transportation, individuals can more easily secure employment, access healthcare and educational services, and engage in social and cultural activities. This will enhance social mobility and foster greater connectivity between regions.

Additionally, differences exist in policy implementation. Some cities in China may impose broader or more precise regional restrictions compared to Jakarta. This variation can be attributed to the vast size and dense population of many Chinese urban areas. Conversely, in Jakarta, the government's restrictions are limited to specific zones and primarily focus on reducing the number of private vehicles based on their license plate numbers. This policy

entails two primary provisions: vehicles with odd-numbered plates are prohibited from entering designated areas or roads on even dates during certain operational hours, and vice versa (Luo et al., 2022). The restrictions enforced by the Jakarta government mainly target areas prone to traffic congestion. For instance, the policy tends to concentrate on busy zones, such as Central and South Jakarta, where more than 5 road segments adhere to the Odd-Even rule compared to the West and East Jakarta regions, where only a few segments are affected (Azuma & Utami, 2023). However, certain outskirts or remote areas of Jakarta remain unaffected by the Odd-Even system regulations, resulting in a limited coverage area for these rules. This disparity underscores the variation in coverage between Jakarta and Beijing concerning the implementation of the Odd-Even system.

However, it is important to acknowledge that there are numerous noteworthy commonalities. The primary objective of this second policy is to mitigate congestion and air pollution, hence positively influencing urban air quality. These parallels provide a foundation for the exchange of ideas and knowledge between nations concerning the achievements and difficulties encountered in the implementation of odd-even policies. When examining the execution of the odd-even policy in Indonesia, particularly in Jakarta, numerous notable elements may be observed that can be introduced or enhanced. Initially, modifying the temporal aspect of policy implementation can be crucial for achieving success. Indonesia has the ability to modify the timing of policy implementation by conducting daily assessments of traffic conditions, ensuring its efficacy at all times. Furthermore, the utilization of technology can be enhanced to effectively uphold and implement policies, such as employing surveillance cameras or automated systems that can promptly and precisely identify infractions. In addition, public education is crucial to ensuring widespread acceptance and successful implementation of this strategy. Disseminating unambiguous information to the public regarding the objectives and advantages of odd-even policies can foster enhanced comprehension and endorsement.

In addition to affecting air pollution and traffic congestion, the Odd-Even strategy has a big impact on social welfare and national security. Through lowering the quantity of motorized vehicles on the road, this policy obliquely enhances national security. This is also consistent with research (Alam, Fawzi, Islam, & Said, 2022) that describes traffic management tactics as a preventative measure that can lead to disorder and provide possibilities for criminal activity, both of which are detrimental to national security. In addition, lowering motor vehicle exhaust emissions contributes to a healthier and cleaner environment, both of which enhance people's quality of life. Decreased respiratory illness cases and enhanced overall health are two immediate health benefits of reduced air pollution. Thus, in alongside solving traffic problems, the Odd-Even policy also aims to promote general national security and make society safer and healthier. In addition, lowering motor vehicle exhaust emissions contributes to a healthier and cleaner environment, both of which enhance people's quality of life. Decreased respiratory illness cases and enhanced overall health are two immediate health benefits of reduced air pollution. Thus, in addition to addressing traffic issues, the Odd-

Even policy also aims to promote general national security and make society safer and healthier.

CONCLUSION

The Odd-Even policy in Beijing, aimed at curbing traffic congestion and air pollution, has proven effective despite initial resistance, reducing vehicle emissions by 40% over two years and encouraging a shift to alternative transportation. Jakarta faces similar challenges, exacerbated by rapid urbanization and inadequate public transit. Initiatives like the Jaklingko program and Transjakarta bus improvements have been made but further action is needed. Both cities must address societal resistance and logistical hurdles in policy implementation, with recommendations including flexible timing adjustments and enhanced enforcement. Continued investment in public transit and urban planning is essential. These experiences emphasize the importance of proactive policy interventions in urban transportation, offering Jakarta the opportunity to emulate Beijing's success and achieve a sustainable urban future through collaborative efforts.

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