The International Conference on Interdisciplinary Humanities and Communication Studies
DOI: 10.54254/2753-7048/5/20220563

Is Sharing Mobility a Solution to the Air Pollution Problem: Taking Delhi as an Example

Yinzhen Lin[1,a], Qile He[2,b], Jiatong Liu[3,c,*], Jingning Wang[4,d]

[1]*Whittle School and Studios (Shenzhen campus), Shenzhen, 518000, China*
[2]*Beijing 21st Century International School, Beijing, 100142, China*
[3]*Wuhan Britain-China School, Wuhan, 430070, China*
[4]*Nanjing Foreign Language School British Columbia Academy, Nanjing, 210008, China*
a. Lin18938849864@163.com, b. qilehe1123@gmail.com, c. liujiatong2023@163.com, d. muku.mooka0206@gmail.com
**Corresponding author.*

Abstract: The sharing economy is a social and economic system built around the sharing of resources. Advances in big data and online platforms in recent years have facilitated the growth of the sharing economy, resulted in some successful sharing model featured with sustainability. In this paper, we analyzed the pollution problem and situation of sharing EV market in Delhi to evaluate the feasibility of applying sharing mobility to the city. We refered to primary literatures and reports about the local condition in Delhi. According to our analysis, sharing mobility is not applicable in Delhi due to its detrimental air pollution and inadequate infrastructure.

Keywords: Sharing Economy, Delhi, Carbon emission, Electronic car.

1. Introduction

In today's world, the sharing economy, as a newly developed economic model, permeates the entire economic structure and people's daily lives, not only injecting new vitality into economic development but also facilitating people's lives. The sharing economy refers to an organization or individual with idle resources given the right to use them with others for a fee, and the sharer receives a return. The sharer creates value by sharing the idle resources of others. Initially, this was developed in many developed countries like Norway and the U.S. Sharing economy is now also prevalent in less-developed countries like Brazil and India to meet specific demands, such as transport, for example. Delhi, the capital of India, has high levels of air pollution mainly created by emissions of carbon monoxide, nitrogen oxide, and nitrogen hydrocarbons [1]. More than 70 lakhs (700000 Rupees) of two-wheelers and several vehicle sharing platforms are used daily in the city. Finding a way to combine vehicle sharing and environmental protection is now becoming a new challenge.

Under such severe conditions, people in Delhi suffer from detrimental health effects, both psychologically and physically, induced by air pollution. Previous studies have shown a strong positive correlation between air pollution levels and adverse health outcomes such as respiratory symptoms, attention-deficit hyperactivity disorder, and the blood levels of lead [2-4]. To mitigate this problem, the government introduced control measures that include the introduction of unleaded petrol,

© 2023 The Authors. This is an open access article distributed under the terms of the Creative Commons Attribution License 4.0 (https://creativecommons.org/licenses/by/4.0/).

DOI: 10.54254/2753-7048/5/20220563

catalytic converter in passenger cars, reduction of sulfur content in diesel, and reduction of benzene content in fuels [2]. The goals of urban transportation policies in Delhi include environmental concerns as well as advancing an accessible and safe transportation system [5]. Although encouraging citizens to shift to public transportation might be a solution, the commuter's satisfaction with the public transportation system in Delhi is low, due to the lack of reliability and comfortability [6]. Therefore, a new sharing transportation system might be feasible as a new solution.

The major objective of this academic paper is to investigate whether the sharing economy is effective for the vehicular pollution problem in today's Delhi city, and what challenges the sharing economy encounters in addressing Delhi's environmental problems. Moreover, we will propose some possible solutions and improvements to the current problems in Delhi, while also looking for some potential alternatives that can also deal with the vehicular pollution issue.

This study mainly takes a qualitative research method, conducted through extensive reading of current literature. We selected "sharing economy" "air pollution" "two-wheelers" "vehicle sharing" and " Delhi, India" as keywords to search relevant articles on JSTOR, Google Scholar, and Sci-hub, while media platforms and official websites of the Indian government also served as our source to get information about environmental actions taken locally. For further discussions and results provided, we look deep into factors that affect the suitability of the sharing mobile market with Delhi, and to generate a comprehensive insight into Delhi's current air pollution crisis.

The structure of the paper will be developed in the following order. In the next part of this paper, we investigate background literature on two-wheeler mobile sharing businesses and the air pollution issue globally and in Delhi, India. In the following part, discussions and analysis will be conducted on various aspects, including Delhi's infrastructure, local people's consumption preferences, natural environment, and technical support from the government. Finally, the last part of this paper provides a conclusion of our work and investigates what remains improved in this study.

2. Pollution in Delhi, India

As stated in the introduction section, pollution has become a serious problem that India must face now, as India now has the worst level of pollution globally. Air pollution not only affects Indian people's health, causing many diseases and deaths, but also costs India 8% of its GDP [7]. According to studies, 12,5% of deaths per year in India were caused by air pollution, and Indian people's life expectancy could have been 1.7 years longer if the air pollution level could be controlled around a minimum level. In fact, the population in India was exposed to an air pollution level that exceeds the standard set by the National Ambient Air Quality Standard. "76.8% of the population were exposed to more than 40 $\mu g/m^3$ of PM2.5 per person, With Delhi, a typical megacity in India, suffering the most serious air pollution, greater than 125$\mu g/m^3$ per person, ranking first as it has the highest population-weighted mean exposure to PM2.5" [8].

Air pollution can attribute to many reasons. The most identified emission sources include motor vehicles, manufacturing, electricity generation, construction, road dust, agricultural waste burning, and household air pollution (HOAP). Carbon monoxide and silicon dioxide emissions are the most rapidly growing source of air pollution. Thirty cities have at least 30% of the households which own a 2-wheel motor vehicle, and 19 major cities have at least 10% of households with a 4-wheel car or utility vehicle. The transport sector has seen an exponential increase in highway freight and the use of diesel. Other than vehicle emissions, in rural areas in India, the poor living standard contributes to heavy household emissions, as India has great disparity in income and wealth between different cities. Nearly 60% of Indian families are using biomass for cooking needs, leading to 250 kilograms of biomass being used every year in cooking. This, in fact, also contributes to the serious air pollution crisis in India, and Delhi [7].

DOI: 10.54254/2753-7048/5/20220563

India and Delhi are facing a similar situation: rapid growing demand and serious pollution. Rising middle-class income and a huge youth population will result in strong demand, while the change in population structure also means a change in people's spending habits. Greater demand for consumption drives the economy to grow while driving the problem of pollution at the same time, imposing an economic burden on the future of India. However, monitoring and controlling pollution was not easy to work. The Indian government still must deal with the challenges of valid data collection and more accurate assessment, which means overcoming their information barriers and getting a border database [7]. But in this study, Delhi is not in the exact same situation as its country, India, the problem of income disparity is not as salient in Delhi. Since vehicle pollution is the largest pollution source in the city, the high demand for cars, due to rapidly growing size of the younger generations and the attendant need for commuting in a megacity, means that the expanding automobile market has become the largest threat to the residents' health.

3. Sharing Economy in Delhi

3.1. The Development of the Cab-hailing Market and Ride-Sharing Platforms

With the help of digital technology, products that are idle and underutilized are easily shared with others. In this article, the authors discuss how the sharing economy is contributing to economic sustainability in Delhi, India. While India's sharing economy is just getting started, the Indian economy is increasingly accepting it in the areas of transportation, hospitality, and shared office space [9]. The sharing economy business model took its initial scale with Uber's operations in the Indian market. At the same time, there is another company in India that also provides cab-hailing services. which is ola, a local Indian company. Its main competitor in India is Uber. They have almost the same operating model and compete. Japan's SoftBank is an investor in both companies in India. Just Like Uber, ola also became a well-known sharing economy player with the launch of "Ola Share" in 2015, with a model similar to UberPool. It appears to be a viable solution to growing road congestion and dangerous pollution. The Indian government is also promoting the use of these sustainable ride-sharing platforms by increasing their links with them. These ride-sharing platforms have greatly changed urban transportation and optimized the local environment. The problem with these platforms, however, is that they require industry professionals and regulators to legalize and regulate their operations [9]. Ola and Uber taxi service providers, in general, have come under public criticism for violating a Delhi High Court order banning surge pricing. The Delhi government has imposed price caps on taxi fares, but these suppliers are not complying with the law. In addition to threatening to ban their services in some states, the state government has issued notices to end surge pricing in response to some customers. Therefore, the Delhi government has strengthened its control in this regard for better management.

3.2. The Development of the Electric Vehicle Market

As India's environmental problems intensify, electric vehicles are seen as more advantageous in the future. Electric vehicles are more environmentally friendly than conventional vehicles as a new form of transport. Indian academics believe that electric vehicles are a better choice compared to conventional vehicles in terms of emission reduction. They have conducted a review and forward-looking projection of them from 2005 to the present and believe that with the development of electric vehicles, CO_2 emissions will be reduced by 14% to 100% by 2050 [10]. This shows the full potential of electric vehicles in terms of environmental protection. Electricity, a common source of energy in everyday life, is cheaper than petrol. In terms of price, electric cars are also more accessible to most people. Electric cars are cheaper compared to conventional cars. And the maintenance costs of electric cars are also lower. This makes it affordable for more families who want to buy a car [11]. Currently,

DOI: 10.54254/2753-7048/5/20220563

36% of the sample say they would choose an electric car when buying or replacing a car. 82% of the 600 current owners say they are likely to buy an electric car in the next few years [11]. This shows a positive attitude towards the development of electric vehicles. In addition to this, India has taken plans to implement a policy for the development of electric vehicles. the NEMMP plans to increase the inventory of electric vehicles in the four-wheeled passenger vehicle segment to 14-180 million units by 2020 [11]. Delhi offers purchase incentives, tax exemptions, and free parking to encourage the use of electric vehicles. The development of electric vehicles is considered viable but is still faced with a small existing base, few development companies and teams, and the construction and improvement of charging stations and some facilities.

3.3. Challenges for Emerging Sharing EV Market to help Improve Delhi Air Condition

Through reading relative materials and studies about the EV market in Delhi, we found that it will be hard to see an effect if efforts are made to apply the share economy model in the EV market and hope it will increase the usage of EVs, and thus to see a reduction in carbon emission that will improve Delhi's air condition. In fact, Delhi is now facing a lot of challenges that resist it from fixing this air pollution problem. Challenges mainly come from two aspects, Delhi's ambient air condition, and Delhi's poor infrastructure level, which failed to provide suitable soil for sharing EV market to grow.

4. Extremely Polluted Environment

According to recent data from CPCB, Delhi has an average of 125 milligrams per cubic meter of PM2.5, which over exceeds the standard level of WHO. Under these special conditions, sharing economic models, especially those that have proved successful in other less polluted countries, may not be considered a solution in Delhi.

In the past five years, a new sharing model has become exceptionally popular in many countries – – "dockless bike-sharing". This sharing mode changes the traditional concept of ownership and creates a circulated value for bikes. It's focusing on providing another transporting option of 0-5 km short trips which take too long for a walk and not convenient enough to take public transportations or cars. Users could rent either a bicycle or an electronic scooter, pay the fee by hours and mileage traveled, and get to their destination. In megacities like Beijing and Shanghai, this mode has achieved great success and brought various benefits. Metropolis usually have severe traffic during rush hours. Under such circumstances, commuters could take the shared bicycle to reach their destination [12]. The research done by Tan et al. in Beijing suggests that this kind of bike-sharing reduces the intensity of tidal traffic in Beijing and, thereby, reduces greenhouse gas emissions [13].

However, this sharing model does not apply to the extent of Delhi. Cycling in dense urban areas, cyclists would expose to road traffic noise and air pollution [14]. Given the aforementioned poor environmental condition of Delhi, cyclists are even more excessively exposed to both noise and harmful gas. These factors would trigger adverse health impacts on them, such as respiratory and cardiovascular diseases, certain types of cancer, annoyance, and stress. According to the study done by Apparicio et al., cyclists could reach the daily mean noise exposure of dB Laden in 29, 21, and 13 min on a residential street, tertiary road, and primary road in an area with moderate predicted values of noise; they could also intake risk value of NO2 per hour in 27, 24, 23 min on a residential street, tertiary road, and primary road [15].

4.1. Quality of Air Pollution Database

Data is important for the local government to determine suitable policies to eliminate air pollution in this city. Quality of data ensures studies are conducted with the highest validity. Accessibility is based on this, as valid and understandable data can help aware the public of the harmfulness of driving

DOI: 10.54254/2753-7048/5/20220563

fueled vehicles. Also, without accurate data, the Indian government may misrecognize the contribution of fuel cars to the percentage of PM2.5 in the air, and the current research will not be convincible for policymakers to prioritize the air pollution problem ahead of economic development.

Data about one particular pollutant, PM2.5 is sparse. According to research conducted by the Public Health Foundation of India in July 2017, apart from the National Air Quality Monitoring Program (NAMP) does not cover monitoring PM2.5 in the air, the Central Pollution Control Board (CPCB) provides a 5 min average estimation, but it is less extensive geographically, and it limits the access to the industrial stack emissions database [7].

The quality of the existing data is also worrying. Although CPCB has developed various means of quality assurance, still many problems caused by miscalibration pose pressure on the database collected. “In December 2015, the CPCB’s monitoring facility collected air quality data at the Indian Institute of Technology Madras (IITM) campus and reported the value of PM2.5 to be almost eight times higher than the prescribed standard.”. Many similar mistakes were identified from stations such as IGI (Southwest Delhi). The data collected is not typical enough to represent the condition of the city, as there are many data points missing during the period analyzed and when stations were still functioning [7].

4.2. Mixed Source of Air Pollution

Delhi is one of the most polluted large cities in the world, according to the UN and Air Visual 2018 daily averages and the World Health Organization [16]. Delhi is growing, it has a large and growing population, but with that, it has become a polluted city. Over the past decades, the development of Delhi has made the local pollution situation in Delhi worse. When air pollution in India increases dramatically, it can lead to a severe impact on the local area and residents, especially in winter. The air pollution index can even reach three times above the safe index. According to the U.S. Environmental Protection Agency, air pollution kills one person every two minutes in India, and air pollution alone kills about 1.7 million people in an average year [16].

The Delhi government and have tried to count on the sharing economy to play a role in Delhi and even in the whole of India. In Delhi, some sharing economy companies such as Uber and ola have played a role. According to the local Environmental Protection Agency, vehicle exhaust emissions are the largest contributor to air pollutants in Delhi. This accounts for 18% to 40% of air pollution in the whole of Delhi. These sharing economy companies have indeed reduced carbon emissions in Delhi [17], and more people will choose the way such as carpooling to travel and commute, which directly reduces the number of vehicles in traffic and leads to less fuel consumption in Delhi.

However, controlling vehicle exhaust emissions is not enough to completely improve Delhi's air pollution problem. According to the National Environmental Engineering Institute of India (NEERI), Delhi generates nearly 8 billion tons of solid waste every day [17]. The problem is that the Delhi government does not have an effective way to solve or degrade these wastes. Their current practice is usually to burn these wastes in garbage stations, which release dangerous air pollutants into the atmosphere, resulting in more serious air pollution. Meanwhile, the second obvious reason for the increase in air pollution in Delhi is the population explosion. Over the past decade, Delhi's population has grown by more than 7 million people (according to the United Nations) [17]. Such a sharp increase in population will inevitably lead to an increase in consumption, emissions, and pollutants, which will also make air pollution more serious.

Therefore, it can be seen that the pollution in Delhi is not only the pollution of vehicles but also a large part of it is caused by factors such as improper disposal of garbage and population explosion.

DOI: 10.54254/2753-7048/5/20220563

5. Lack of EV Charging Stations in Delhi

Infrastructure is another issue that is resisting the development of electric vehicles in Delhi. According to the latest news and articles from Delhi, the use of electric vehicles and the availability of charging points is still in their infancy in Delhi at the moment, indicating that Delhi has not been fully engaged in developing the infrastructure for charging stations in the last few years. While using electric mobile is not as easy as expected, developing sharing EV market will not result in reducing carbon emissions.

According to data reported by CPCB's official website, by July 2020, there were 427 charging stations in India, only 97 charging stations, and 379 charging points in Delhi. What these stations are facing is the charging demand from 139733 EVs registered [18]. Compared to Shanghai, which has established 41thosand charging stations for 125 thousand E-mobiles, this amount of charging stations may not be sufficient to satisfy the demand derived from electric mobile usage.

However, establishing an EV charging station is expensive, also complex. A standard EV charging station is responsible for satisfying the needs of different types of electric mobiles. Therefore, "per requirement charging infrastructure (AC/DC) is also required.", as this served as an alternative method to charging. The most recommended and efficient infrastructure would be a Battery Swapping Station, with a particular system designed to swap the batteries with discharged ones. However, the fixed cost of building such a station would be extremely expensive because it requires great space and technical support. By examination, the cost was to be covered after seven years from the station starts functioning Special two-wheeler-dominated market [19].

India had launched a NEMMP plan to increase its four-wheeled electric vehicle inventory. In total, India will have around 9.66 lakh EVs which is 96600 by 2022. However, 90% of the electric vehicles in India are two- and three-wheelers. This means that the scheme may not be completed on time. Due to the constraints of economic development and infrastructure development, the Indian government has not been able to implement some of the schemes in an idealistic manner.

6. Conclusions

The aim of this paper is to examine the sharing economy market in India and its air pollution problems caused by vehicles and analyze the feasibility (or infeasibility) of a sharing economy market that could save India from its pollution problems, achieving environmental goals while remaining practical and enforceable.

6.1. Sharing Mobility is not fit for Delhi's Situation

Based on our analysis and evidenced by the data, we can conclude that the sharing mobility might not work well in the case of Delhi. The source of pollution is not just vehicle emissions, it also includes excessive population expansion and ineffective waste disposal methods. Another objective reason is that the infrastructure in Delhi is very poor and cannot support the implementation of sustainable sharing economy enterprises.

6.2. Limitations

We've examined several factors that undermine the effectiveness of using sharing mobility to solve the pollution problem in Delhi. These factors cover the composition of pollution, the current circumstance of the sharing market in India, and the infrastructure in Delhi. However, due to the deficiency of feedback from current sharing market customers, we could not evaluate whether users are willing to use the sharing mobility facilities. Future researchers could collect data from users to

DOI: 10.54254/2753-7048/5/20220563

determine their attitudes toward sharing mobilities usage, combine the subjective feedback with systematic data analysis, and obtain a more comprehensive result.

Acknowledgment

Jiatong Liu, Yinzhen Lin, Qile He, and Jingning Wang contributed equally to this work and should be considered co-first authors.

References

[1] *PTI. "Number of Vehicles on Delhi Roads over 1 Crore, with More than 70 Lakh Two Wheelers: Economic Survey." Economic Times, 23 Feb. 2019, https://economictimes.indiatimes.com/news/politics-and-nation/number-of-vehicles-on-delhi-roads-over-1-crore-with-more-than-70-lakh-two-wheelers-economic-survey/articleshow/68128689.cms?from=mdr*

[2] *Kalra V, Chitralekha KT, Dua T, Pandey RM, Gupta Y. Blood lead levels and risk factors for lead toxicity in children from schools and an urban slum in Delhi. J Trop Pediatr. 2003;49:121–3.*

[3] *Siddique S, Banerjee M, Ray MR, Lahiri T. Attention-deficit hyperactivity disorder in children chronically exposed to high level of vehicular pollution. Eur J Pediatr. 2011;170:923–9.*

[4] *Rizwan, S. A., Baridalyne Nongkynrih, and Sanjeev Kumar Gupta. "Air pollution in Delhi: its magnitude and effects on health." Indian journal of community medicine: official publication of Indian Association of Preventive & Social Medicine 38.1 (2013): 4.*

[5] *Goel, Rahul, and Pallavi Pant. "Vehicular pollution mitigation policies in Delhi." Economic and Political Weekly (2016): 41-45.*

[6] *Jain, Suresh, et al. "Identifying public preferences using multi-criteria decision making for assessing the shift of urban commuters from private to public transport: A case study of Delhi." Transportation Research Part F: Traffic Psychology and Behaviour 24 (2014): 60-70.*

[7] *Public Health Foundation Of India. "Air Pollution and Health in India." Centre for Environmental Health, July 2017, https://ceh.org.in/wp-content/uploads/2017/10/Air-Pollution-and-Health-in-India.pdf.*

[8] *Yin, Peng, et al. "The Effect of Air Pollution On Deaths, Disease Burden, And Life Expectancy Across China And Its Provinces, 1990–2017: An Analysis For The Global Burden Of Disease Study 2017". The Lancet Planetary Health, vol 4, no. 9, 2020, pp. e386-e398. Elsevier BV, https://doi.org/10.1016/s2542-5196(20)30161-3.*

[9] *Kaushal, Leena Ajit. "The Sharing Economy and Sustainability: A Case Study of India." Valahian Journal of Economic Studies, vol. 9, no. 2, 2018, pp. 7–16., https://doi.org/10.2478/vjes-2018-0013.*

[10] *Sharma, Ishant, and Munish K. Chandel. "Will Electric Vehicles (Evs) Be Less Polluting Than Conventional Automobiles Under Indian City Conditions?". Case Studies On Transport Policy, vol 8, no. 4, 2020, pp. 1489-1503. Elsevier BV, https://doi.org/10.1016/j.cstp.2020.10.014.*

[11] *Jain, Deepty. "Viability Assessment Of Electric Cars For Personal Use In India". IATSS Research, 2021. Elsevier BV, https://doi.org/10.1016/j.iatssr.2021.12.005.*

[12] *Xue, Xingjian, et al. "A Choice Behavior Model of Bike-Sharing Based on User Perception, Psychological Expectations, and Loyalty." Journal of Advanced Transportation, Apr. 2022, pp. 1–14. EBSCOhost, https://doi.org/10.1155/2022/6695977.*

[13] *de Hartog, J. J., Boogaard, H., Nijland, H., & Hoek, G. (2011). Do the health benefits of cycling outweigh the risks? Epidemiology, 22. https://doi.org/10.1097/01.ede.0000391897.18320.1d*

[14] *Eriksson*, C., Bodin, T., & Selander, J. (2016). The burden of disease from road traffic and railway noise in Sweden – quantification of healthy life years lost. ISEE Conference Abstracts, 2016(1). https://doi.org/10.1289/isee.2016.3354*

[15] *Apparicio, P., Gelb, J., Jarry, V., & Lesage-Mann, É. (2021). Cycling in one of the most polluted cities in the world: Exposure to noise and air pollution and potential adverse health impacts in Delhi. International Journal of Health Geographics, 20(1). https://doi.org/10.1186/s12942-021-00272-2*

[16] *Providence, Amaechi. "Top 7 Causes Of Air Pollution In Delhi 2022 - Environment Go!". Environment Go!, 2022, https://environmentgo.com/causes-of-air-pollution-in-delhi/.*

[17] *Phukan, Rumani. 2022, https://www.mapsofindia.com/my-india/cities/delhi-tops-in-pollution-how-can-it-be-controlled.*

[18] *"Find A Charging Station Near You". Ev. Delhi. Gov. In, 2022, https://ev.delhi.gov.in/#:~:text=Delhi%20now%20has%20over%20one%20lakh%20electric%20vehicles%2C,has%20increased%20multi-fold.%20WATCH%20VIDEO%20Delhi%20EV%20dashboard.*

[19] *"Electric Vehicle Charging Infrastructure in India: E-Mobility: ISIEINDIA." Imperial Society of Innovative Engineers, 23 Aug. 2021, https://imperialsociety.in/electric-vehicle-charging-infrastructure-in-india/.*