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IMPLEMENTATION OF CONGESTION CHARGE IN NEW DELHI: FEASIBILITY AND ENVIRONMENTAL IMPACT

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Abstract *Technology plays a major role in our daily lives. With the advancement in technological usage, there has been a crescendo of relative negative impacts as well. On similar terms, with the increase in the number of vehicles on road there have been several negative impacts of the same along with its positive outcomes. There has been a steady increase in the pollution levels in several cities across the world wherein the road density is positively related to the population density of the particular city. This has resulted in elevated global warming issues, health hazards, and loss of valuable man hours, to name a few. Many cities across the world have contrived various plans to counter these issues of pollution and congestion. Some cities in the United States of America have constructed additional lanes to ease traffic, whereas some cities like London and Singapore, levy taxes and charges for fuel emission above permissible limits in a marked area. In recent years the city of New Delhi in India has seen exorbitant levels of traffic congestion and consequent pollution increase. This paper focuses on the impact of levying congestion charges in order to ameliorate the dire consequences of traffic congestion and pollution.*

Keyword: *Congestion Charge, Traffic Congestion, Pollution Reduction*

INTRODUCTION

New Delhi, the capital city of India, with a total area of 42.7 relies heavily on its transport infrastructure. It has a colossal and complex transport system which includes Delhi Metro, Delhi Transport Corporation (DTC) bus system, auto-rickshaws, cycle-rickshaws, e-rickshaws, Grameen Sevas, and taxis.

New Delhi also has one of the highest road densities in India which is approximately 155 km per 100,000 population and is accommodating about 82 vehicles per kilometer. The problem emanated when the transport infrastructure could not commensurate with the demand for public transport systems. More and more people started depending on private vehicles. Over the years this changeover has grown tremendously forcing people to use private vehicles. This has resulted in increased congestion on the roads. There are about 5.84 million registered vehicles in the city as of 31 March, 2016, which is the highest in the world among all cities most of which do not follow any pollution emission norm. Due to traffic congestion on the roads it was also found that Delhi loses nearly 4.2 million man hours every month while commuting between home and office.

Another problem which contributes towards traffic congestion in the city is the burgeoning population. The transport infrastructure was found to be in conflict with the rising demand of increased population. According to census 2011 about 97.5 percent of total population of Delhi lives in urban areas and remaining 2.5 percent in rural areas. This migration from rural to urban areas is a leading reason for increase in population in the urban areas of the city. According to estimated figures total population of Delhi in 2016 is 24,998,000 (16,856 per square kilometer), which makes Delhi the world's third most populous city after Tokyo and Jakarta.

The outcomes of traffic congestion have been many but to state a few-unnecessary delays and waste of time, increase in road traffic fatalities, air and noise pollution, fuel wastage etc.

Environmental problems prevailing in Delhi especially air pollution and increased number of vehicles on the Delhi roads has been the impact of traffic congestion. Delhi is also one of the most heavily polluted cities in India, having one of the country's highest volumes of particulate matter pollution.

Traffic congestion in Delhi is yet to see the worst case scenario. In India, the saturation level is estimated to be 683 vehicles per 1,000 people, versus 807 for China and 853 for the US.

Though the government adopted various strategies in order to bring down the traffic density like odd-even road rules, metro rail expansion projects, multiple lane flyovers, increased number of low floor buses etc., there has not been any noteworthy or significant improvements in the

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congestion levels and the ever increasing pollution levels. This has reached such alarming extent which calls for immediate attention and a solution needs to be worked out. As we look at various other cities across the world which has faced similar or same issues we can see that there is a way to exhort the general population to use the public modes of transport for purpose of commuting. This can be done by way of administering a charge known as congestion tax for the private vehicles in a particular marked zone.

A congestion charge is a system for charging users of public goods that are subject to congestion due to excess demand. It can be applied to the usage of bus services, electricity, metros, railways, telephones. Similarly road pricing is charged to reduce traffic congestion. Under this system of charging, the private vehicle users are required to pay a price for the use of public roads. This is meant to discourage the general public from use of private vehicles and encourage use of public modes of transport. Consequently, it is estimated that the traffic flow will be regulated and lesser vehicles on the roads means limited fuel emissions and lesser air pollution levels

Under the system of congestion charging in London, various discounts are available for a number of categories of people namely

- The residents who live in the charging zone or in a designated area next to the zone you may be eligible for heavy discounts.
- Vehicles with nine or more seats are eligible for 100% discount of the congestion charge in order to encourage car pooling.
- Cars or vans with emission levels lower than the maximum permitted limit are also eligible for 100% discount from congestion charges.

The implementation of congestion charge is not free from challenges and oppositions as well.

The acceptance of the general public is essential for the success story of congestion scheme in New Delhi but this does not come easily. The general public would be concerned about certain issues which impact the feasibility of implementation of such charges which can be assessed based on factors like equity issue, land use effects, and dual taxation issue.

Equity issue refers to the concern regarding whether the residents of the restricted area will be given equal treatment or what about those who have no alternative route, what about low income groups and so on. Land use effects refer to the issues like “will it drive down house prices”, “kill the city centre”, or “destroy local businesses” etc. Road user charging schemes will inevitably have impacts upon the geographical areas and economic sectors that they interface with. Lastly dual taxation issue refers to the concern of the public regarding the payment of road taxes as well as congestion charges. The question is raised, since the road taxes are paid for maintenance of roads and congestion charges are levied as road user charges. Therefore it is necessary for the policy makers to answer these questions in order to gain public acceptance of the congestion charge scheme

The amount raised by way of congestion charges from road users is to be used on improvements to the transport across the capital city. The revenue generated can be efficiently utilised to develop and improve the transport facilities which can be used as an incentive to encourage the general public to turn towards the use of public modes of transport rather than private vehicle use. This can help in reducing the use of private vehicles which in turn reduces the environmental pollution contributed by the private vehicles.

Therefore, congestion charges are levied with a primary aim to cut traffic and congestion in the city along with reduction in pollution emission levels by way of private vehicle users.

REVIEW OF LITERATURE

In the paper titled “Road Pricing Lessons from London”, Santos, Fraser, and Newbery (2006) have assessed the original London Congestion Charging Scheme (LCCS) andits impacts on the road traffic density and pollution levels. It promotes the proposed extension of the congestion charging scheme which includes the areas of Kensington and Chelsea. Their study includes the computation of the cost benefit ratio which shows that simple methods of congestion charging can have sizeable impacts on benefits from reducing the traffic congestion. It has remarkable effect on reduction of pollution levels within the city. The results have been such that the authors have mentioned of possibility of transferring this experience to other cities like Paris, Rome, and New York City.

Chadwick in his paper titled “Congestion Charging and the walking classes” (Chadwick, 2003), sheds light on the sewage situation, gridlock and causalities of pedestrians and cyclists which was prevalent in the city prior to 2000. He reports that implementation of congestion charges would encourage drivers to adopt more healthier options of travelling like walking or cycling which would reduce the number of causalities in the city due to heavy traffic flow. On similar terms, in the paper titled “London Congestion Charging”, Santos, Button, and Noll (2008) discuss the reasons for the London Government to introduce Congestion Charging, the basic goal of the Congestion Charging and the expected results of the same. They have also discussed the working of the congestion charging scheme, exploring the costs, benefits and its impacts on traffic, transport infrastructure use, land use effects, and property pricing.

In more recent years, reports have been made on the implementation issues related to introducing the congestion charge scheme. This has been discussed in paper titled "The Feasibility of Implementing a Congestion Charge on the Halifax Peninsula: Filling the Missing Link of Implementation" (Althaus, Tedds, & McAv, 2011) using a case study on the said region.

It was discovered that the political policy implementation was not enough, rather the public acceptance of the congestion charge policy was tantamount to the success of the congestion charge scheme. A study conducted in Malaysia (Mahirah, Azlina, Nazirah, & Ridzu, 2015) analyses the willingness of general public of the congestion charge scheme using 366 respondents. The results showed that individual income, occupation of the respondents and the price bid toll payment have sizeable impact on the willingness of respondents to pay congestion charges in order to reduce traffic congestion.

Based on these researches several policies were advocated to curtail and reduce the effects of traffic congestion and environmental pollution.

RESEARCH DESIGN

Title

A study on the feasibility and environmental impact of implementation of Congestion Charge in New Delhi.

Objectives

A study was conducted with the objective of finding out the feasibility and the environmental impact of implementation of congestion charge in the capital city of New Delhi.

1. To study the feasibility of implementation of congestion charge in New Delhi based on the equity issue, land use effects and the dual taxation issue.
2. To assess the avenues for application of funds raised through congestion charge.
3. To study the impact of implementation of congestion charge in reducing environmental pollution.
4. To study the impact of congestion charge on the gridlock/traffic congestion in New Delhi.

Scope of the Study

This study covers the methodology of implementing congestion charges in the highly populated roads of New Delhi. It also states how congestion charges or road user charges can help in reducing the number of pollution emitting vehicles on the road which in turn will help in bringing down the alarming pollution level in the city. When the number of vehicles per square meter falls, the air pollution caused by these vehicles can be brought to a minimum level.

Congestion charging is a new concept in India. According to recent reports it was also found that the capital city of India has the highest pollution level in the world and ranks one among the top 10 highly polluted roads. The implementation of congestion charges has been proven to be effective in various cities around the globe particularly London, Stockholm and Singapore.

Hence the implementation of congestion charges in New Delhi can also help in reducing the number of vehicles on road as well as the ever increasing air pollution levels.

Sampling Technique

The sampling technique used for collecting the data necessary for conducting the study was simple random sampling wherein every individual is chosen by chance and each member of the population has an equal chance of being included in the sample chosen.

Sample

Primary Data

A total of 100 respondents who are private vehicle users and commute to their work place in the central region of New Delhi are selected as sample. The primary data required for the study were collected from the selected respondents by using questionnaire.

Secondary Data

Secondary data were collected from news articles, journals and websites.

Research Methodology

The data collected by way of questionnaire were analysed and interpreted using various tools like percentile methods and chi square test using the SPSS software in order to obtain findings directed towards the objectives.

Scope for Further Research

Further research can be conducted in order to study the impact of implementation of congestion charges in enforcing regular fuel emission test for vehicles as well as adoption and implementation of stringent Bharat Stage Emission Standards in order to bring down pollution levels.

Data Analysis

Reduction of Environmental Pollution through Congestion Charge

HO: The implementation of congestion charge does not have an effect on reducing environmental pollution.

H1: The implementation of congestion charge has an effect on reducing environmental pollution.

Table 1: Test Statistics

	Would implementation of congestion tax help in reducing environmental pollution?
Chi-Square	3.240[a]
df	1
Asymp. Sig.	.072
a. 0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 50.0.	

Interpretation

From Table 1, we can see that there is no significant effect of implementation of congestion charge on reducing the environmental pollution levels prevalent in the city as the significance level is more than 0.05(0.072). Therefore we accept the null hypothesis (H0) and reject the alternative hypothesis (H1).

Reduction of Traffic Congestion through Congestion Charge

H0: The implementation of congestion charge does not have an effect on the gridlock situation.

H1: Theimplementation of congestion charge has an effect on the gridlock situation.

Table 2: Test Statistics

	Would implementation of such charge help in the traffic congestion and grid-lock situation in the city?
Chi-Square	3.240a
df	1
Asymp. Sig.	.000
a. 0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 50.0.	

Interpretation

From Table 2, we can see that there is significant effect of implementation of congestion charge in reducing the traffic congestion prevalent in the city as the significance level is less than 0.05 (0.000). Therefore we accept the alternative hypothesis (H1) and reject the null hypothesis (H0).

Modes of Public Transport Preferred as Alternative

Table 3: Preference of Mode of Alternate Transport

Particulars	Observed	Percentage
Nil	41	41
Taxi	6	6
Metro	38	38
GrameenSeva	15	15
Total	**100**	**100**

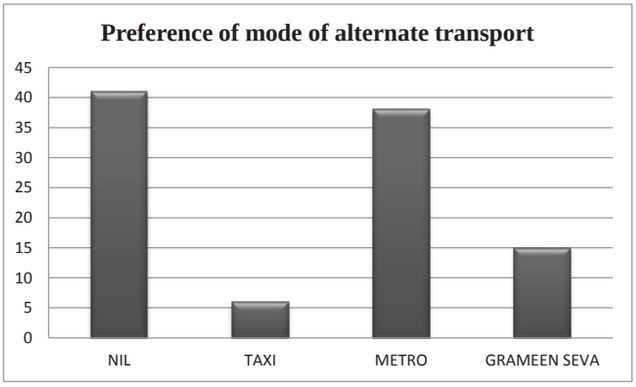

Fig. 1: Preference of Mode of Alternate Transport

Interpretation

From Fig. 1, we can say that most of the respondents (38%) prefer metro rail as a preferred mode of public transport over the other modes of public transport like taxi and Grameen Seva. We can also see that 41% of respondents (unwilling to implement congestion charge) do not prefer any modes of public transport.

Equity Issue

H0: There is no significant concern regarding the equity issue on implementation of congestion charges.

H1: There is significant concern regarding the equity issue on implementation of congestion charges.

Table 4: Test Statistics

	Are you concerned regarding the equity issue in implementing congestion charge?
Chi-Square	77.440a
df	1
Asymp. Sig.	.000
a. 0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 50.0.	

Interpretation

From Table 4, we can say that there is significant concern regarding the equity issue on implementation of congestion charge since the significance level is less than 0.05 (0.000). Hence we accept the H1 hypothesis and reject the H0 hypothesis.

Land Use Effects

H0: There is no significant concern about the land use effects on implementation of congestion charge.

H1: There is significant concern about the land use effects on implementation of congestion charge.

Table 5: Test Statistics

	Are you concerned regarding the land use effects in implementing congestion tax?
Chi-Square	70.560[a]
Df	1
Asymp. Sig.	.000
0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 50.0.	

Interpretation

From Table 5, we can say that there is significant concern regarding the land use effects among the respondents since the significance level is less than 0.05 (0.000). Therefore we accept the alternative hypothesis (H1) and reject the null hypothesis (H0).

Dual Taxation Issue

H0: There is no significant concern regarding dual taxation issue on implementation of congestion charge.

H1: There is significant concern regarding dual taxation issue on implementation of congestion charge.

Table 6: Test Statistics

	Are you concerned regarding the dual taxation issue in implementing congestion charge?
Chi-Square	3.240a
df	1
Asymp. Sig.	.072
0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 50.0.	

Interpretation

From Table 6, we can say that there is no significant concern regarding the dual taxation issue among the respondents since the significance level is more than 0.05 (0.072). therefore we accept the null hypothesis (H0) and reject the alternative hypothesis (H1).

FINDINGS AND SUGGESTION

This chapter deals with the findings suggestions and conclusion drawn from the study. The purpose of the study was to analyse the feasibility and the environmental impact of implementation of congestion charge.

Findings

1. The study reveals that a majority of respondents about 59% are aware of the term congestion charge or otherwise known as road user charges.
2. The study also reveals that 79% of respondents are aware of the gridlock/traffic congestion situation which is prevalent in the central region of Delhi and the old Delhi area.
3. According to the study, the 79% of respondents aware of gridlock were also aware of the environmental hazards in the capital city.
4. The analysis of data reveals that all of the respondents are private vehicle users.
5. The study reveals that majority of the respondents aware of the traffic congestion and environmental pollution in the city were willing to accept the implementation of congestion charges.
6. The study also reveals that respondents falling in the age group of 18-30 were willing to accept implementation of congestion charge whereas respondents in the age group of above 60 years were reluctant for its implementation.
7. According to the study, the respondents falling in the age group of 18–30 years undertook regular fuel emission control test every 3-6 months whereas most of the respondents falling in the age group of above 60 years undertook fuel emission control test once a year.
8. The study revealed that majority of respondents have an opinion that implementation of congestion charge would not help in reducing air pollution levels in New Delhi.
9. Through the study, we can see that 59% of respondents have an opinion that implementation of congestion charge would help in reducing the number of vehicles on road and bring down the traffic congestion situation in New Delhi.

10. The study revealed that, out of the 59% respondents who were willing to accept the implementation of congestion charge wished to apply the revenue generated in developing the public modes of transport as alternative modes of transport.
11. The study also revealed that out of the 59% respondents who wish to apply the revenue generated in developing the public modes of transport, a majority of 38% preferred Metro Rail whereas 15% preferred GrameenSeva, and the rest 6% preferred taxi or cab services.
12. According to the study, it was seen that most of the respondents who are against the implementation of congestion charge were concerned regarding the equity issue relating to such implementation of road user charges.
13. The study revealed that 92% of respondents were concerned regarding the land use effects and most of them fall under the age bracket of 60 years and above and a small percentage in the 30-60 years age bracket.
14. The study also revealed that a majority of the respondents were not concerned about the dual taxation issue.

Suggestions

1. The maximum traffic congested areas should be targeted like the central region of Delhi and the old Delhi area, for implementing congestion charges in order to spread the traffic flow.
2. The peak hours should be fixed during the office hours in the morning and the early evening hours as opposed to the 9am till 5pm rule applicable in most other cities in the world where congestion charges have been implemented.
3. For the congestion charge to be a success story, there should be stringent rules followed by every private vehicle user during the peak hours.
4. The best suited method for implementing congestion charges in Delhi is the toll booth method as in the city of Stockholm, which requires less setup cost.
5. Public vehicles and residents who reside in the restricted area can be exempted from payment of congestion charges while entering the restricted area.

RESEARCH GAP

There is lack of prior research studies on adoption and implementation of congestion charges in India.

LIMITATIONS

The study which was undertaken had the following limitations to it:

1. All the respondents are private vehicle users, hence the opinion of public transport users is not considered.
2. Lack of cooperation from the municipality authorities in New Delhi.
3. Lack of secondary data pertaining to capital city New Delhi.
4. Time constraint in collection of data.

CONCLUSION

New Delhi, the capital city of India, is the most polluted city in the world. It is also one of the most populated cities in terms of vehicles per square meter. As a consequence there has been an increase in the number of chronic respiratory illnesses among the residents of traffic congested areas of the city. The pollution level is also at an all time high which keeps escalating.

It is the need of the hour to address these pressing issues. Therefore the concept of congestion charges was thought of in order to bring down the air pollution levels and the vehicle population on the road. The road user charges will encourage the road users to switch to the use of public modes of transport like the Metro Rail and DTC buses rather than using private vehicles for daily transportation needs. As a consequence there will be lesser vehicles on the road which will instantly decrease the level of air pollution caused through emission from vehicles on road.

The implementation of congestion charges can also have other positive effects like it encourages car pooling among commuters who travel daily to the same place. It also provides the government with the resources and opportunity to develop the public modes of transport as well.

This can be seen by way of example of other cities in the world like London, Stockholm, Oregon, Singapore etc wherein the implementation of congestion charges has drastically reduced the pollution levels and successfully addressed the problem of traffic congestion prevalent in the cities. It has also helped to develop the culture of car pooling among the commuters and the government has been able to provide top notch public transport facilities.

Therefore we can say that it is important to analyse the feasibility and the environmental impact of implementation of congestion charges in the city of New Delhi in order to understand benefits and drawbacks of adopting a congestion charge scheme.

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