Odd Even Road Rationing Scheme in Delhi 2016: Efficacy and Engagement

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Abstract

The alarming rate of depleting limited natural resources is forcing inhabitants of the earth to find solution to the issue on a war footing. From Rio Summit to Rio+20 Summit to other brain storming sessions at regional and local level, stakeholders are striving hard to find a solution to the ecological imbalances and ways to restore environmental degradation. Are efforts at the macro-level being percolated to the bottom of the pyramid? It is essential to identify micro-level behavioural insights including psychological and socio-cultural factors that form the fabric of any society. This study aims to capture individual consciousness in accepting such practices that lead to sustainability. The paper discusses responses of the people in the city of Delhi to the strategies adopted for regulating environmental pollution due to vehicle movements. A survey was conducted on residents of Delhi to share their opinion on Odd Even Scheme, a road rationing initiated by the Government of Delhi to bring down armingly hazardous levels of pollutional. Data were evaluated with statistical techniques. The responses were mixed and indicated that constant motivation and reinforcement were needed to bring effectiveness. However the level of social engagement due to the scheme was commendable.

Keywords: *Sustainability, Government initiatives, Odd even scheme, Air pollution*

Introduction

Urbanisation has induced the process of large scale migration to cities where job, education, income, medical facilities and standard of living are better. Cities in developing countries like India as a consequence of urbanisation, have been experiencing a rapid increase in motorisation. Economic and infrastructural growth aided with use of improved quality of life have led to increase in demand for independent and personal mode of transport. In Indian context, the possession of a car is the symbolic of rising status in the society. As per estimation of research study (Dargay, et al, 2007), India will be the third largest hub in terms of car ownership as compared to other countries in the world by 2030. Another study by Swamy (2004) on the ownership patterns of cars revealed Delhi as the largest market for private cars followed by Mumbai, Kolkata and Chennai. The public transport is far from adequate while Delhi has always been dependent on road transport and hence the public is heavily dependent on private vehicles. According to the Economic Survey of Delhi, 2014-15, the number of motor vehicles on road in Delhi touched 88.27 lakh - an increase of 6.4 per cent over previous year. The State owned carrier, Delhi Transport Corporation (DTC) operated 3781 low floor AC and Non-AC CNG buses and 924 standard floor buses to take care of about 39 lakh passengers daily. Additionally 1406 cluster buses operated in 9 clusters by the private sector operators in the same year. Increasing trends of car ownership and use are likely to increase environmental and social costs, such as congestion, high energy consumption, smog and other externalities (Sperling, 1995, Goodwin, 1996; Greene and Wegener, 1997) and similar patterns are visible in Delhi too.

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Background

Urban cities across the globe face problems of huge air pollution from road traffic and therefore preferred to

opt for road rationing measures to reduce congestion and pollution. A careful review of policies on restrictions on usages of vehicles for serious pollution related issues around the world reveals that many policy makers tried rationing on the basis of odd even registration numbers with some success. And hence, this policy of driving restriction got emulated and became popular tool among the policy makers.

The first road rationing incidence was observed in early 70's when Buenos Aires, the capital of Argentina banned half of the automobiles from entering the city centre on the basis of odd or even registration number. Similarly Caracus, the capital of Venezuela observed road rationing program in 1980, another City Athens also observed such restrictions during 1985-1991. In Mexico in 1989, the Government introduced 'Hoy No Circula' (Do Not Circulate Today), a one day per week driving restriction based on the number plates from 5.00 am to 10.00 am. Bogota in Columbia also introduced the vehicular restriction known as Pico Y Placa (Peak and Plate) in 1998 (Breithaupt and Fjellstrom, 2002).

Other cities such as Sao Paulo in Brazil (1997), Medellin in Colombia (1998), and Santiago in Chile (1986 and extended in 2001) all introduced driving restrictions to reduce automobile use (Grange and Troncoso, 2011). Interestingly in 2008, Beijing imposed restriction on vehicular movement by allowing odd even numbers to drive on alternate days. It was during the Beijing Olympic Games and the experiment reported successful outcomes in terms of reduced congestion and decrease in pollution levels (Wang, 2010).

Paris in 2014 introduced odd- even restrictions just for a day and revoked the decision after a day because pollution control objectives were attained. Such policy measure aimed at reducing pollution had mixed response in different cases and at times failed to generate desirable response. Mexico (1989) witnessed a drop in pollution levels, but people starting buying odd even numbered cars and circumvented the rule, thereby increasing the pollution levels by 13%. Similarly in Bogota, drivers started driving in off-peak hours rendering the policy worthless.

Odd Even plan in Delhi, the Capital of India

In 2014, World Health Organisation (WHO) named Delhi as the world's most polluted city amongst 1,600 cities. In the months of October to December 2015, Delhi's air quality slumped to hazardous level, with PM2.5 pollutants (fine particles that cause most of the damage to lungs) soared to 12 times above the safety level of 2.5 mgs per cubic meter. Delhi high court compared living in the city equivalent to living in 'gas chamber' and ordered immediate measures that included check on construction sites creating dust pollution, implementing ban on waste burning and providing air masks to traffic personnel (Singh, 2015).The real-time readings of nearly all monitoring stations put the levels of the coarse PM10 and the finer PM2.5 particles at "very poor" exposing the residents to serious health hazards (Table 2).

The gravity and seriousness of the issue can be understood more by findings of a few studies which highlight the ill-effect of air pollutants on the health of people breathing that air. A study was conducted by Central Pollution Control Board (MoEFCC, 2012) on 11628 school going children (7757 boys and 3871 girls) from 36 different parts of Delhi and compared with the another study on the group of children from 15 schools in rural West Bengal and 2 schools located in Uttaranchal (4536 children, 2950 boys and 1586 girls). The analysis showed that Delhi children had 1.8 times more upper respiratory symptoms and two times lower respiratory symptoms as compared to children in the control group. The situation becomes worse in the months of winter when PM10 levels are highest in Delhi. Another report by World Allergy Organisation (2013) indicated high respiratory disorders in children residing in certain pockets of Delhi (Mazoomdaar, 2014). The study titled Global Burden of Disease (Cohen, 2016) identified air pollution as the fifth largest killer in India with asthma as the common cause. Alarming findings by the scientists from Jawaharlal Nehru University in 2013 indicated rise in toxins in air primarily due to rise in the numbers of vehicles plying on Delhi Road.

Such disturbing reports were enough triggers for the High Court to direct the Central and the State Government of Delhi to submit an action plan primarily focussing on dust particles in air and vehicular emissions. Respecting the directives of High Court, the Government of Delhi suggested implementation of odd-even scheme from January 1, 2016 - January 15, 2016 with the ambitious objective of reducing air pollution in Delhi.

Objectives of the Study

1. To understand the efficacy of Odd Even scheme in Delhi as an intervention to reduce air pollution in both the phases of 2016 (Phase1: January 1-15, 2016; Phase2: April 15-30, 2016)
2. To review the perception of residents of Delhi with respect to Odd Even Scheme implemented in Delhi during both the phases.
3. To gauge the social engagement during Odd even Road rationing scheme periods.

Table 1: The Odd Even Pilot Project Highlights

Phase / Duration / Timing	Traffic Restriction Plan	Applicable on	Exemption	Resource Deployment	Personnel Resource Deployment	Additional Support/ help line
Phase I January 1, 2016 - January 15, 2016 8 am - 8 pm (No curb on Sundays)	Odd-numbered cars will be allowed to run on odd dates while even-numbered vehicles can only ply on even dates.	Four wheelers passenger / private cars	25 categories that include women drivers, CNG certified vehicles, two-wheelers, cars carrying differently abled, VIP and Emergency vehicles.	4,600 DTC Buses, 1400 Cluster buses, 3000 additional buses including 1400 school buses and increased frequency of Delhi Metro Rail service.	Delhi traffic police (200), Enforcement team from transport department (66), sub-divisional magistrate team (40), Delhi Transport Corporation team (45), Delhi Integrated Multi-Modal Transit system team (15), and Delhi Metro Corporation teams (29).	Civil Defence Volunteers (200 teams) Two helpline numbers were provided to the residents of Delhi to register complaints and furnish suggestions
Phase II April 15, 2016 – April 30, 2016 8 am - 8 pm (No curb on Sundays)	Odd-numbered cars will be allowed to run on odd dates while even-numbered vehicles can ply only on even date.	Four wheelers passenger / private cars	In addition to the categories in Phase 1, vehicles carrying students in school uniform.	6000 plus buses including DTC and private players, Increased frequency of Delhi metro service, school buses could not be pooled in this phase	Delhi traffic police (2000), 400 ex-service-men	5331 civil volunteers (1331 more than phase 1); Volunteers provided with caps, umbrellas and drinking water, due to extreme hot weather conditions two helpline numbers were provided to the residents of Delhi to register complaints and furnish suggestions.

Methodology

The present study is descriptive in nature and carried out in two parts. In the first part extensive review of leading daily newspapers was done during the period when the odd even road rationing experiments were conducted. It also included a close scrutiny of Air Quality Index by SAFAR, India. The second part of the study is on the basis primary data for the study collected through opinion survey of the respondents by administering a structured questionnaire. The survey was conducted 15 days after both the phases were over to gauge responses of people on the road rationing issue.

The survey was based on convenient sampling for residents living in North and Central Delhi.. The questionnaire was distributed to 1600 respondents (800 after each phase). 1025 complete responses were returned, 525 after first phase and 500 after second phase making the response rates as 65.5% and 62.5% respectively. In the first phase, 48% of the surveyed people were working professionals both in public and private organisations, 29% were students, 18% were Businessmen and 5% were homemakers. While in the second phase 55% respondents were working professionals, 15% students, 25% self-employed and 8% homemakers. The mean age of the respondents in first phase was 35.5 years and 36.2 years in the second phase.

The questionnaire included 10 questions besides demographic details and focused on the experience of the respondents during the two phases of road rationing experiment. The questions were intended to seek citizen's opinion on various issues such as private vs public transport, strategies, problems faced during the period and readiness for future. One of the questions even asked for opinion from the respondents to make Delhi a less polluted place.

Data Analysis and Findings

1. Mode of Transport

In this section (Table 3) perception of participants related to Odd Even scheme are discussed. When asked about the mode of travel that people prefer while going to work, 48% participants travel by their own car, followed by Metro Rail travellers (30%), bike (7%), bus (5%) and cab/auto/taxi (8%) (Table2). However in phase 2, 40% preferred travelling by their own car and percentage of people travelling by Metro Rail dipped slightly by 2% and the number of people travelling by private taxi or cabs rose significantly by 6%.

2. Opinion of people related to Odd Even Formula

It was interesting to know (table 4) that 57% of respondents appreciated this scheme in Phase1 and it further rose to 63% after Phase 2.70% did not report any inconvenience caused to them during Phase 1 which rose to 78% in Phase 2. People supported the exemption given to the women drivers (Phase 1: 56%, Phase 2: 61%) but did not appreciate the exemption to two wheelers (Phase 1: 62%, Phase 2: 68%). The opinion of respondents was in favour of continuation of the scheme in Delhi, where 51% (Phase1) and 67% (Phase2) wanted the scheme to come back.

3. Coping Alternatives if the scheme returns

According to Table 5, the proportion of the respondents in favour of using public transportation fell from 42% to 32% from Phase1 to Phase2. The number of respondents keen to buy another car with alternate number rose by 15% as compared to first phase. Scattered response was obtained in favour of buying a two-wheeler or bicycle but people were open to the idea of opting for a car/ taxi pool.

4. Perceived change during Odd Even Scheme

Further analysis revealed interesting observations. Only 10% of the response favoured the scheme as a mean to decrease pollution during Phase1, the sentiment further declined in Phase 2 (6%). The respondents were very much in favour of the scheme (Phase 1: 54%, Phase 2: 60%) and considered it a successful plan as traffic on the roads was less and commuting was better (Table 6).

4. Suggestion by Respondents

One of the questions was open ended which solicited respondents opinion to bring down pollution and traffic congestion and make Delhi a better place and Table 6 shows five best responses from Phase 1 and Phase 2.

Discussion

There has been a lot of debate over the effectiveness of Odd Even Scheme and its impact on Delhi's air quality. While reports by some agencies indicate dip in some specific pollutants during this time , other studies refute the claim. The disagreement amongst agencies on the method of data assessment has resulted in ambiguity in results (Chatterjee, 2016). The Centre for Science and Environment and Delhi government have adopted the method of measuring daily peaks in the level of pollutant citing that the policy objective was to reduce peak pollutants during winters. Other agencies like Central Pollution Control Board (CPCB) measured daily average of data using more scientific way (MoEFCC, 2014). Yet, another set of experts relied on spot measurement of pollutants by collecting real

time roadside and traffic signal data with the conviction that reduction in number of vehicles would definitely reduce roadside pollution levels.

The air quality and traffic congestion assessment in TERI report (Sharma, et al. 2016a) is based on the pollution monitoring done by the Delhi Pollution Control Committee (DPCC) at four locations, namely Mandir Marg, Punjabi Bagh, Anand Vihar and R.K Puram in Central, West, East and South Delhi. TERI report (Sharma, et al., 2016) measuring the effect of the odd-even scheme on air quality and traffic congestion, showed that average over 5 locations for PM 2.5, NO2, and PM10 was higher multiple times than the recommended 24 hourly standard. These five locations, namely Bahadurgarh, Lodhi Road, Ghaziabad, Gurgaon and Noida were separate from the four monitoring stations set up by the Delhi Pollution Control Board (DPCB) in the first phase of the scheme that covered the four directions of Delhi.

In spite of all the differences in opinions, Air Quality Index (AQI) developed by CPCB has so far emerged as the acceptable index of measurement. And so far the findings of the index do not substantially prove improvement in the quality of air during the Odd even trial scheme. Data in Table 7 from various stations show no clear trend, however there is clearly a sharp fall in PM2.5 pollutants post Odd even trial period (Table 8). This can be attributed to multiple factors like, shorter time span of the scheme, multiple exemptions, restrictive 8 AM to 8 AM time schedule, extra plying of taxis, and other environmental phenomenon beyond control.

The average pollutant levels (PM2.5, PM10, NO2) were higher in the first phase of the scheme relative to the non-scheme period. Same results were obtained for the second phase but relative to the first phase , averaged pollutant concentrations were much more in the second phase. The technical studies carried out by DPCC and TERI specifically cited meteorological factors such as lower wind speeds for increase in pollutant concentration in both the phases. The TERI study on the first phase (Sharma, et.al, 2016a) does not attempt to isolate the influence of the odd-even scheme on Delhi's air quality, however, the second study (Sharma, et al, 2016) found that the scheme was successful in reducing the PM2.5 pollutant concentration to the extent of 4%. This was mainly due to restriction of vehicle movements and resultant reduction of emissions, due to less idling emissions and dust rising in the air. Similar findings are given by Goel, et al (2016) in a preliminary study on the scheme's impact conducted by UrbanEmissions. Info on air quality being inappreciable though data collected on basis of the sample size have been insufficient to make reliable and useful conclusions. Other possible causes for the low impact of the scheme might be exemptions to the rule for vehicles provided in the scheme and multi-vehicle ownership of cars acquired by commuters (either existing or adopted) to circumvent the scheme. Though the Odd Even trial scheme by the Delhi government could not bring desired reduction in pollution but had a long lasting impact on other factors. For example a new form of citizenry could be seen among the people of Delhi with the awareness of taking responsibility rather than leaving it to the Govt. In the stage of implementation of the scheme, many stakeholders of the society from ordinary citizen, high court of Delhi , Delhi Government and media were equally involved.

Conclusion

The study has inferred the following –

a. While scheme was experimented in other parts of the world, it had a very high novelty quotient for the residents of Delhi. The scheme brought the concern for environment via the imposition of traffic restrictions to a higher priority for most of the citizenry; however, the first phase roused more street corner discussions and debates relative to the second phase.

b. The scheme led to mental churning out in search of alternatives which could have lessened the inconvenience of the people on account of traffic restrictions. These not only came from area experts but also from the affected common man. Also, open discussions (through informal verbal communications, social networking websites and micro-blogging sites) were visibly high on providing suggestions in this regard.

c. Social engagement on account of this scheme was heightened by media participation. The Government and the concerned departments made huge publicity to create awareness and generated much involvement indirectly.

d. Routes to circumvent forced participation in the scheme were visible and reported in the second phase of the scheme.

e. The success of the scheme was limited to easing traffic congestion while the prime motive of improving the air quality was largely unmet. This was not on account of the relaxations but technically due to many other sources of air pollution that were out of the ambit of this scheme.

One of the prime areas of concern and creativity will be to increase the efficiency in the usage of public transport. Connectivity, availability and frequency at all touch points will be a game changer, be it for Metro Rail, Delhi buses, auto or taxis. DTC buses carry far more passengers than Delhi Metro Rail, improving bus services through proper routing and proper maintenance can keep private cars off the road. Dust contributes around 26% of PM10 and PM2.5. Growing and planting more trees and grass, vacuum-cleaning, paving footpath, covering construction sites and material can bring some respite to the people. And above all, effort must be made to sustain the changed attitude of people and reinforce it with further developmental initiatives doable at grassroots levels. Delhi government has started the war against air pollution in the city, it should now push through various ideas, convert them into workable projects, make stringent policies and implement them. A collaborative effort between the police and the local Government, central Government, experts and citizens are desired to create a model of sustainable development.

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Table 2 : Air Quality Index (AQI)

Description	AQ1	PM10 Pg/M 24hr org	PM2.5 Pg/M 24 hr org	CO PPM 8hr org	03 PPB 24 hr org	N02 PPB 24 hr org
Good + Satisfactory	0-100	0-100	0-60	0-1.7	0-50	0-43
Moderate	101-200	101-250	61-90	1.8-8.7	51-84	44-96
Poor	201-300	251-350	91-120	8.8-14.8	85-104	97-149
Very Poor	301-400	351-430	121-250	14.9-29.7	105-374	150-213
Severe	401-500	431-550	251-350	29.8-40	375-450	214-750

Source: http:\\safar.transport.res.in

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Table 3: Mode of Travel during two phases of Odd Even Road rationing

Mode of Travel	Phase 1 (Response Rate in %)	Phase 2 (Response Rate in %)	% Change in response
Own car	48	40	(-8)
Metro Rail travellers	30	28	(-2)↓
Bike	7	8	(+1)↑
Bus	5	10	(+5)↑
Cab/auto/taxi	8	14	(+6)↑

Table 4: Opinion related to Odd Even Scheme

Opinion of Respondents	Response Rate Phase 1(in %age)		Response Rate Phase 2(in %age)	
	Yes	No	Yes	No
Appreciated Odd Even Scheme	57	45	63↑	37
Faced problems due Odd Even Scheme	30	70	22	78
Support exemption to women drivers	56	44	61↑	39
Support exemption to two wheelers	38	62	32	68
Support Continuation of Odd Even Scheme in Delhi	51	48	67↑	33

Table 5: Coping Alternatives if the scheme continues/ re-run

Coping Mechanism if the scheme continues	Phase1(%age of Respondents)	Phase2(%age of Respondents)
Use Public Transport	42	32
Convert Car in to CNG Car	26	21
Buy another car with other odd/even license number	15	30 ↑
Buy a scooter/two wheeler since they are exempted	4	3
Buy a bicycle	6	3
Car Pool/ Office cab/other support	7	20 ↑

Table 6: Perceived Change during Odd Even Scheme

Perceived Changes	Phase1 (%age of Respondents)	Phase2 (%age of Respondents)
Significant decrease in Pollution levels	10	6
Decrease in traffic and congestion on roads	54	60
Responsible attitude of people	15	23
Feels like a burden	7	5
No apparent change anywhere	17	6

Table 7: Top five responses (Phase 1 and Phase 2)

1	Improve public transport
2	Plant more trees
3	CNG vehicles
4	Decrease factories in and around Delhi
5	Ban diesel cars
6	Continue with odd even scheme
7	Increase metro frequency

Central Pollution Central Board
Air Quality Profile (Daily average in pg/m3)
(CAAQM Stations of CPCB in Delhi)

Stations (CPCB) Stations	Pre Odd Even (25-31 December, 2015)							During Odd-Even (1-15 January, 2015)					
	Parameters	PM25	C0	N02	03	Benzene	S02	PM25	C0	N02	03	Benzene	S02
DMS Shadipur	Max	141	1244	72	48	3	31	279	1990	126	45	8	26
	Min	65	114	35	34	1	22	79	280	14	2	1	7
NSIT Dwarka	Max	298	698	12	40	7	28	261	1061	3	66	11	8
	Min	52	484	5	18	3	8	93	438	9	4	2	5
IHBAS Dilshad Garden	Max	221	1006	71	NA	NA	19	295	1610	148	NA	NA	12
	Min	85	321	51			7	107	371	29			6
Parivesh Bhawan	Max	NA	NA	NA	NA	NA	NA	408	NA	NA	NA	NA	NA
	Min							119					

Central Pollution Central Board
Air Quality Profile (Daily average in pg/m3)
(CAAQM Stations of CPCB in Delhi)

Stations (CPCB) Stations	Pre Odd Even (25-31 December, 2015) During Odd-Even (1-15 January, 2015)						
	Param Eters	PM25	C0	N02	03	Benzene	S02
DMS Shadipur	Max	165	604	47	34	4	13
	Min	76	278	20	13	1	7
NSIT Dwarka	Max	235	675	28	32	7	7
	Min	160	502	17	13	3	4
IHBAS Dilshad Garden	Max	229	1316	44	NA	NA	8
	Min	103	363	27			7
Parivesh Bhawan	Max	237	NA	NA	NA	NA	NA
	Min	114					