

Banning Two-stroke Auto-rickshaws in Lahore: Policy Implications

MOHAMMAD RAFIQ KHAN

1. INTRODUCTION

The motorcycles and rickshaws, due to being equipped with two-stroke engines, are the most inefficient vehicles in complete burning of fuel and thus contribute most to emission of air pollutants in the environment. The major pollutants from two-stroke engines are Carbon Monoxide (CO), Nitrogen Oxides (NO_x), Hydrocarbons (HC) and Particulate Matter (PM). Their presence in the environment causes a number of respiratory diseases and other illnesses. For example, CO and NO_x are notorious irritants of respiratory system and have potential suffocating action. PM causes premature death, and illness. Its presence is accompanied by increased hospital admissions for asthma and other bronchial conditions such as bronchitis, etc.

None of the locally assembled rickshaws meets standards fixed by Pakistan Standards Quality Control Authority for smoke emission. According to the PSQCA code, two-stroke exhaust contains 4.5 percent and old two-stroke has six percent carbon mono oxide [IRIN (2006)]. The studies conducted in India, Bangladesh and Nepal; with or without the assistance of international institutions, have alarmed Asian Countries including Pakistan to be vigilant about the gloomy environmental future being created by three-wheelers and take protective measures to avoid future health averse situation. For example, a study conducted on Dhaka revealed that two-stroke auto-rickshaws with number around 50,000, which is comparable to that in Lahore—around 60,000, is responsible for 36 percent of the total pollution caused by all vehicles on roads of Dhaka [Rab (2001)]. This means that out of PM estimated as 34,733 tons per annum, the contribution by two stroke three wheelers comes out to be 12,504 tons per annum which is an alarmingly high figure for a medium size but highly populated Dhaka. A similar situation in Lahore has led to the issue that is the subject of analysis here.

The issue of banning two stroke engines in Punjab has been under active debate both in public and private sectors and also in public circles for the last few years. A number of arguments, some in favour and some against the ban, have appeared in the print and electronic media. Reports have also appeared in the form of government press releases. The government has said a lot in favour of the ban, while the likely affectees in near future, particularly rickshaw drivers, rickshaw owners and two-stroke engine

Mohammad Rafiq Khan <drrafiq@lahoreschool.edu.pk> is Senior Research Fellow, Lahore School of Economics, Lahore.

manufacturers, have also vented their grievances and fears through the media and have also organised rallies to express themselves publicly.

The active debate started in 2004 when Government of the Punjab announced intention to ban two-stroke engine operated vehicles in the Province after December 2004. Some analysts tried to compile the two-stroke vehicle statistics, views of the drivers of three wheelers, community users of rickshaws, government officials, etc, to alarm Government of the Punjab about the aftermath of the ban [IRIN (2006)]. Soon after the ban, there appeared an article in "*Jang*" dated 5th March 2005 on this issue [Haider (2005)]. The analyst foretold, "The ban on manufacturing and plying two-stroke rickshaws may hit more than 0.3 million families in the province" that will finally translate into unemployment of hundreds of the workers in about a dozen two-stroke rickshaw factories and of rickshaws drivers".

The rickshaw drivers are characterised by illiteracy, large size households with an average of four to six per family, rickshaw ownership, permanent settlement in big cities with small owned residences, rickshaw driving as a family business, etc. Their survival is tagged with staying in Lahore and other big cities due to more opportunities in these cities and better facilities such as health, education, etc. as compared to small towns.

2. BACKGROUND

The protests against contamination of air environment by two-stroke vehicles particularly the auto-rickshaws form a long story. The major event that translated into intense consciousness of Punjab Government to make a strategic plan to ban two stroke vehicles in the Province is a Supreme Court Decision (The August Supreme Court, Lahore? In *Suo Molu* Case No 3.2003 that passed Order Dated May 23, 2003) that directed the Provincial Governments to control vehicular smoke and noise pollution caused by two-stroke auto-rickshaws for the protection of environment. In order to implement the Supreme Court's Decision, a ban on auto-rickshaws was notified with immediate effect from January 1, 2005 (Government of the Punjab, Transport Department Notification No.SO-TR-1/Misc-71/88 (P-II) Dated Lahore January 2005).

After the ban was imposed, there were repercussions from different circles that were concerned in different contexts. The immediate affectees being rickshaw drivers, they challenged the imposition of ban in court and also protested on the roads particularly on that of Lahore, under the banners of the Rickshaw Drivers Union of the Punjab and demanded elimination of rickshaws from major cities according to a practicable plan that could save the subsistence living of large number of households in the Province. They were later joined by All Pakistan Auto-Rickshaw Manufacturers Association on the plea that the industry would be doomed as a result of ban imposition. It demanded the government to extend the deadline for at least a year for banning the two-stroke rickshaw in the country as that would help in enabling industry to shift its manufacturing pattern of four stroke rickshaw manufacturing. To counter the moves by the activists from the affected parties, a rally was taken out on The Mall from GPO to Regal Chowk to draw attention of the government for the elimination of air pollution especially vehicular pollution on Saturday, March, 20, 2005. Hundreds took part in the procession. The rally demanded the implementation of Government's Transport Policy in true spirit (<http://www.nation.com.pk>, 2005). Meanwhile, Government of the Punjab also

encouraged some new players to manufacture CNG based four-stroke engines for production of environmentally safe rickshaws.

Taking into consideration the gravity of the situation, Government of Pakistan also stepped in the matter to assist concerned parties in resolution of the issue. According to a press report, there was a split between the Centre and the Province about the imposition. One of the report states, "A federal government institution, Engineering Development Board (EDB) has decided not to deny permission to new two-stroke rickshaw assemblers. However, the Board has left the rest of the issue with the provincial governments to deal with this affair according to their local prevailing laws" [Rizvi (2005)].

The Government of the Punjab has taken a tough stand on the ground that the ban was in the interest of providing a healthy environment to the citizens. Moreover, it claimed that Transport Department Government of the Punjab decided to ban the use of two-stroke rickshaws as public transport after consultations with the manufacturers, Environment Protection Department and Pakistan Standards and Quality Control Authority. It is hopeful to control the situation but a tug of war between different parties is yet in progress. At the primary level, the study will focus on the nature of the problem and the strategy followed by the stakeholders to ban two-stroke auto-rickshaws in Lahore.

3. REVIEW OF LITERATURE

Although, no study seems to have been undertaken that specifically focuses on two-stroke rickshaws, a number of studies have been carried out that relate with the problem. Some of these studies are on general vehicular pollutants and damages caused by them and thus also offer some remedial measures (Report on Air Quality in Mexico 2004, South Asian Network for Development and Environmental Economics), some are general presentations on policy issues with regard to two and three wheelers made in Workshop on Reduction of Emissions from 2-3 Wheelers, Hanoi, Vietnam, September 5-7, 2001 [Tuladhar (2001), Walsh (2001), Rab (2001), Khan (2001), Roychowdury (2001), Khaliquzzaman (2001), Johnsen (2001), Zaidi (2001)] and some on methodology of estimating benefits and costs of controlling air pollutants [World Bank (2005), SOS Arsenic Net, World Car FreeNetwork (2005), State Bank News (2004)]. Some of these studies have also tagged the problem of man pulled rickshaws with other studies. A few are outlined below below.

Ayana Goren and Sarah Hellman carried out a survey in 1999 to compare the frequency of respiratory symptoms, respiratory diseases and lung function of children residing in an area exposed to vehicular pollution to that of children residing in an area exposed to less air pollution [Goren and Sarah (1999)]. The results indicated a trend of greater frequency of respiratory symptoms in exposed areas as compared to less exposed areas. The difference was also interpreted in terms of difference in the socio-economic conditions of two groups.

In 2004, a Workshop was organised in Mexico [A Report (2004)]. The focus was on Air Quality in Mexico. The conclusions optimistically expressed the hope that new technologies and clean fuels especially ultra-low-sulfur-content gasoline and diesel could reduce pollution from new vehicles by more than 95 percent.

South Asian Network for Development and Environmental Economics has recently proposed to carry out a study to isolate the impact of vehicular pollution, particularly of three wheelers, on human health of Dhaka with an intention to associate strike days and non-strike days with reported non-trauma deaths and number of hospitalisation cases, especially caused by cardiovascular and respiratory diseases, in the corresponding days (South Asian Network,).

Sister Community Partnerships between USA and India in context of fuel efficiency of three wheelers have translated into the research results given below for reducing air pollution (Sister Community Relationship, USA-India).

- “Firstly, a commercially available, lighter-weight, rickshaw with a low-pollution four-stroke engine replacing the traditional two-stroke engine.
- Based on a positive result from a wide-scale city trial, full commercialisation of a simple hybrid system using a small gasoline engine and high-performance batteries.
- Hydrogen fuel cell powered prototype rickshaw, that could be commercially viable if adequate support infrastructure can be put in place.
- Significant improvements in energy efficiency, and substantial reductions in greenhouse gas emissions and other pollutants.
- Clean air in Indian cities.
- Thriving commercial relations between Indian and US companies and cities”.

The presentations made in the conference in Hanoi were of general nature and dealt with the policy issues [Tuladhar (2001), Walsh (2001), Rab (2001), Khan (2001), Roychowdury (2001), Khaliquzzaman (2001), Johnsen (2001), Zaidi (2001)]. These presentations also included useful studies on India, Pakistan, Bangladesh and Nepal. Almost all the papers dealt with the strategies to reduce air pollution from vehicles on road. Some of them also included useful data about the extent to which different vehicles including two-stroke rickshaws polluted environment and also provided useful data for calculating air pollution costs.

The study from Pakistan presented the results of an education campaign on reduced lubrication for rickshaws in Pakistan [Zaidi (2001)]. According to this report, the major functions of lubrication are reduction of friction, removal of heat, reduction of noise, detergency, reduction of smoke and reduction in exhaust blockade provided these are used in optimal proportion with motor fuel. The standards are 2 percent but rickshaw drivers use lubricants up to 12.5 percent concentration. The study highlighted the environmental effects of excessive use of lubricants that translate into poor mileage, engine heating, dense smoke, high noise, and high carbon monoxide emission in the exhaust. For example, if lubricant used is 12.5 percent, it emits dense smoke and 1.8 percent CO as compared to invisible smoke and 0.6 percent CO if the concentration is 2 percent.

The remaining studies dominantly carried by World Bank and other international institutions [World Bank (2003), World Bank (2005), SOS Arsenic Net, World Car FreeNetwork (2005), State Bank News (2004)] mostly deal with the easing of traffic in different cities with a focus on Dhaka with special reference to man-pulled rickshaws.

After a comprehensive review, the objectives of the work being reported here were defined as follows.

4. OBJECTIVES OF RESEARCH

The objectives of the preliminary research enquiry into the complexity of the problem were as follows:

- Understanding the nature of pollutants liberated into the environment and damages caused by them.
- Understanding the difference between two stroke and four stroke engine technology.
- Development of pattern of growth of rickshaws in Lahore over time.
- To judge whether the decision of banning two stroke rickshaws by Government of the Punjab had a rational basis.
- To fix the future directions of research to identify the implications of banning two stroke engine rickshaws and suggest measures to pacify the affectees.

5. RESEARCH METHODOLOGY

The research methodology involved collection of data at both secondary and primary levels.

5.1. Secondary Data

The secondary sources of data were used to chalk out historical background, build up review of research studies undertaken on motor vehicles including auto-rickshaws and highlighting the distinctive features of two-stroke and four-stroke engines. The major source was Internet. Thus different websites were visited to gather the information that was subsequently computed. The brochures circulated by different manufacturers were also helpful.

5.2. Primary Data

The primary data were collected from different stakeholders and affectees. Appropriate questionnaires were developed to take the responses of the officials/members of the following parties:

- (1) Transport Department, Government of the Punjab Lahore.
- (2) Environmental Protection Department (EPD), Government of the Punjab.
- (3) Planning and Development Department, Government of the Punjab.
- (4) Institute of Public Health, Birdwood Road Lahore.
- (5) Representative manufactures of two stroke auto-rickshaws and four-stroke CNG rickshaws.
- (6) Auto-Rickshaw Dealers Association Lahore.
- (7) The Punjab Rickshaw Drivers Association.
- (8) Representative rickshaw drivers who responded for the pre-test of the questionnaire and some rickshaw drivers driving 4-stroke CNG rickshaws in Delhi and NOIDA, India.
- (9) Bank of Punjab, LDA Plaza, Egerton Road Lahore.

The data were gathered keeping in view a broader perspective of the problem that included the aspects to which this article will lead to, as the data were in significant quantity to answer some primary questions of immediate interest from the policy and governance point of view.

5.3. Interpretation of Data

The data gathered from the secondary and primary sources were computed, interpreted and results were compiled as descriptive research. The general strategy for data interpretation involved the computation and comparison of responses from different respondents to conclude as researcher's opinion or conclusion. If necessary the primary and secondary data information was also combined to draw certain conclusions.

6. RESULTS AND DISCUSSION

6.1. The Components of Rickshaw Exhausts and the Damage They Cause

The major components of rickshaw exhaust include all the components that are included in the exhausts of the vehicles in general because all the vehicles use the same fuel mainly Gasoline. The main difference, of course, is that their exhausts are relatively more damaging as they are equipped with 2-stroke oil engines that cannot burn the fuel completely as a result of which the pollutants are released in higher concentrations that are more damaging. For example, rickshaws emit more smoke that contains both coarse and fine carbon and other particulates. Thus, here it may be appropriate to describe the components of vehicular exhausts in general. A Report from Dublin, Ireland has described the major components of vehicular exhausts such as Smoke, Sulfur Dioxide, Lead, Nitrogen Oxides, and Other pollutants e.g. Carbon Monoxide, Hydrocarbons, and Ozone (A Report, Dublin). The outline briefing this and other reports is given in Exhibit 1 [Statutory, *et al.* (2006), Dockery, *et al.* (1993), Pope, *et al.* (1995), World Bank (2003), Goren and Sarah (1998), Division of Public Health, EPA USA].

Apart from the information computed in Exhibit 1, there are also the combined secondary effects of pollutants that are even more dangerous than the primary effects. For example, NO_x combine with VOCs and form harmful ground-level ozone in presence of heat and sunlight that may cause lung damage, chest pain, coughing, nausea, throat irritation, and congestion. Similarly, damaging ground-level ozone comes from the oxidative degradation of VOCs present in solvents. It is also produced as a result of reactions between chemicals produced by burning coal, gasoline, and other fuels and chemicals found in paints and hair sprays. Acid rain is harmful to vegetation. It tends to change chemical composition of water, and renders it potentially unfit as habitat for all bacteria excluding acid-tolerants. A recent study funded by the National Institute of Environmental Health Sciences, USA has reported that the elderly have higher risk for cardiovascular and respiratory diseases from fine particle pollution [NIH News, USA (2006)].

6.2. Distinction between Two-stroke and Four-stroke Engines

It was surprising that most of the respondents were not clear about the difference between 2-stroke and 4-stroke engines. Some of them even confused number of cylinders

Exhibit 1

Outline Briefing of Vehicle Exhaust Pollutants

Pollutant	Symbol or Formula	Source	Description: Impact/Diseases Caused
Particulate Matter (PM) including PM ₁₀ that is less than 10 Microns in Size.	C & M-Oxides	Vehicle burning diesel fuels	Respiratory disease, lung damage. They reduce visibility and cause breathing problems and permanent lung damage. Smoke, dust, and vapours can remain suspended for extended periods and thus cause continuous damages.
Sulfur Dioxide	SO ₂	Diesel, Mobil oil	Major contributor to smog and acid rain Major collaborator of ozone in smog formation.
Ozone	O ₃	Formed as a result of oxidative breakdown of VOCs and reactions of SO ₂	Respiratory tract, chest pain and persistent cough, affect the ability to take a deep breath, and an increase susceptibility to lung infection Ozone in stratosphere filters UV rays (harmful to humans). Ozone can also damage vegetation and reduce visibility.
Lead	Pb	Pb (C ₂ H ₅) ₄ in fuels	Nervous damage and learning behaviour Averse effects in young children
Nitrogen Oxides	NO _x	Fuels such as gasoline and coal	High: smog harms humans (breathing difficulty) asthmatics, coughs in children, general illness of respiratory system Major contributors to O ₃ -(smog) and acid rain NO _x reacts with (VOCs) to form smog.
Carbon Monoxide	CO	Incomplete burning of fuels	Low:: dizziness, headaches, and fatigue High: Fatal Combines with blood cells to inhibit O-transport.
Carbon Dioxide	CO ₂	End product of combustion	Toxicity, increased breathing rate, unconsciousness. It is a greenhouse gas
Chlorofluoro-Carbons	(CFCs)	Refrigerators ACs and other	Skin & breast cancer Rise to damage ozone layer.
Volatile Organic Compounds	VOCs	Gasoline; other fuels and fuel production	Vehicle emissions are an important source of VOCs Produce vapours easily at room temperature. VOCs include (the principal dry cleaning solvent).

with the number of strokes. Frankly speaking, we in the capacity of researchers were also not very clear about this difference. Thus, it was thought necessary to probe into the literature concerning this aspect and place our clarifications on record for the future guidance of the concerned circles. Requisite concepts are compiled in Appendix 1. A brief mention of distinctive features is given below.

Both two-stroke and four-stroke engines are seen on the roads today. The major point of distinction between two-stroke and four-stroke engines is that the two-stroke cycle is completed in two stages only called Compression and Exhaust, while the four-stroke cycle is completed in four stages that are Intake, Compression, Power/Ignition and Exhaust [<http://www.keveney.com> (2005)]. Each stroke corresponds to one full stroke of

the piston. Thus, the complete cycle of two-stroke translates into one revolution and of four-stroke into two revolutions of the crankshaft to complete the cycle. Due to this distinction, two-strokes are more powerful but consume more fuel and are more polluting also. The four-strokes, on the other hand, are less powerful, more efficient in fuel consumption as they consume less fuel and above all these are less polluting.

6.3. Growth of Rickshaws in Lahore, Pakistan, and Punjab

Our recent enquiry reveals that the number of rickshaws in Pakistan and also in Punjab is a matter of controversy. The major and so far considered authentic source may be Pakistan Economic Survey 2004 and Pakistan Economic Survey 2005. The other sources of information are the press reports and interviews of the representatives of the concerned parties conducted by us.

6.3.1. Lahore Level

Lahore has a lion's share in rickshaw population of Pakistan. The number of rickshaws running on the roads of Lahore is around 60,000 as per registration by the Lahore District Registration Authority. There is no disagreement on this figure. The Rickshaw Dealers Association, of course, told us that the total number of rickshaws in Lahore is around 100,000. The additional 40,000 include rickshaws registered in other districts and unregistered rickshaws. Some rickshaws registered in Lahore are also running in other cities of the Punjab. Of course, current number of rickshaws in Lahore may be 60,000 as balance may be assumed to have shifted to other cities of the Punjab.

6.3.2. Pakistan Level

According to a report presented in Hanoi Conference in 2001 [Zaidi (2001)], the three wheelers were introduced in Pakistan in late 1960s. After three decades, their number rose to 43,000 per estimate of 1991. It more than doubled in 2000 and rose to 94,000. The rickshaws, being "Short Distance" and "Limited Person Carrier", these were initially designed with 2-Stroke Engines. There has been no change in the design of the auto-rickshaws over the last 4 decades.

A journalistic report published in "Jang" that the number of registered rickshaws in Pakistan which were mere 50,862 in the year 1990 and crossed the level of 1, 30,488 by end of 2004 differs from the above report significantly [Haider (2005)]. Their number has more than doubled, while motorcycles and scooters have increased seven-fold over the past 20 years. The majority of these rickshaws, which got registered during the last one decade, were in Punjab only, as NWFP, Balochistan and Sindh governments had already banned the registration of new 2-stroke rickshaws [Rizvi (2005)].

6.3.3. Punjab Level

According to the figure cited by EPD, Punjab, there are about 200,000 vehicles running on two-stroke engines in the province. Per information from the Transport Department, Government of the Punjab, out of the above figure, there are 100,000 two-stroke rickshaws, the major component of which that is 60,000 are running on the roads of Lahore.

6.4. Responses towards Justification of the Ban

In our computations, there was almost a complete consensus on imposing the ban as all the parties accepted that the two-stroke engine rickshaws, being source of injurious air pollutants to human and animal health, were contrary to the national health security. The major point made in favour particularly by the manufacturers for total justification of the ban was that the two-stroke rickshaw technology is obsolete and two-strokes have been banned all over the World. Moreover, these rickshaws have lived their life. Being very old, they are highly noisy, and emit poisonous pollutants such as CO, carbon dioxide, oxides of nitrogen, sulfur dioxide, particulates such as PM10, PM 2.5, etc.

The only opponents were the rickshaw drivers that were scheduled for the pre-test of the survey questionnaire. Almost none of them voted in favour; reflecting a biased and briefed opinion. The major question they raised was “Why we first? Why not diesel based buses, etc?” Although, at this stage, a small part of the universe does not represent the community as a whole, it is an alarm that they may provide the same responses in bulk in the elaborated survey. One logical conclusion that can be drawn at this stage is that if they are in a mood to deny the universal facts then they are unconscious of the consequences of the harm expected from the two-stroke engine rickshaws to the environment. Thus, Government of the Punjab will have to launch a special campaign to train them for their transformation into conscious citizens ready to fulfil their social obligations.

In spite of the existence of big consensus on justification of the ban, almost all affectees including rickshaw manufacturers and dealers strongly disagreed with the modus operandi on different bases. They also added that the grace period was less than due.

As far as the gravity of the pollution is concerned, most of the respondents said that they were all against pollution and believe that the problem should be solved through a mutual consensus.

The major advocates were the Rickshaw Dealers Association. Its members offered highest number of points to support their arguments. These points made by its office holders have been conveyed below while reporting responses on different dimensions of the problem.

6.5. Number of Rickshaw Drivers and Others Affected in Lahore

Both Government Departments and the rickshaw manufacturers told us that the number of affectees in this context was 60,000. The Rickshaw Dealers Association refuted this figure strongly on the basis that none can be behind the wheels for 24 hours. Thus, the members argued that there are a minimum of 120,000 drivers in Lahore even if one driver is assumed to operate rickshaw for 12 hours in spite of the fact that normal man hours per day are 8.

The Association members were of the view that banning of two-stroke has not only affected 120,000 rickshaw drivers but has affected indirectly 1,200,000 souls that are indirectly associated with the rickshaw business. These include Lathe Operators, Oil and LPG-gas Dealers, Body Makers, Mechanics/Mistris, Rickshaw Dealers, Investors, Hood Makers, Rixin Dealers, Welders, Spare Parts Dealers, Manufacturers of Rickshaws and Spare Parts, Dentors and Painters associated with engine, body and chassasis, etc.

Here, it may not be out of place to mention the impact on the labour engaged in rickshaw manufacturing factories. One of the companies said that they had to retrench their labour by 60 percent temporarily. As they were authorized by the government to manufacture CNG rickshaws, they were quite hopeful to recall workers within an-year time. Some manufacturers gave the general remarks that the affected workers will switch over to new technology after a little shop-floor training, and worst come worst, they being technical hand can join any technical workshop for repairs. After taking into consideration the convincing points made by the manufacturers and government officials, we dropped their detailed survey for the study of impact of ban on their socio-economic status.

6.6. Number of Rickshaws Owned by Owners in Lahore and the Rent Charged by Them

Both Government Departments and the rickshaw manufacturers told us that there are some big players in rickshaw business who own even more than 500 rickshaws per head. This information was strongly rebutted by members of Rickshaw Dealers Association. The interviewees said that the maximum number of rickshaws owned by a person may be 10 to 15. The rickshaw drivers also gave the same figure. Some said that maximum was around 50 but none endorsed a figure of 500 or above. Some rickshaw drivers, of course, said that the dealers bought even around 1000 rickshaws from factories and handed over to individual drivers to pay back in instalments.

There was, of course, a consensus on amount of rent charged by the owners. The average rent being charged per rickshaw for twenty four hours as told by the Association was Rs 130. When compared to (100 +150), the figure from other sources, there does not seem to be much difference.

We were also told that most of the rickshaw drivers are driving rickshaws on rent.

6.7. Substitution of Two-stroke by Four-stroke CNG Rickshaws

We were impressed by the confidence expressed by government departments that they were determined to control the situation created by the Ban. The Transport Department has enlisted a couple of pioneers in rickshaw manufacture and has encouraged a large number of new entrants to produce 4-stroke CNG rickshaws to meet the demand within an adequate span of time. So was also the hope of EPD Punjab. Unfortunately, the picture presented by affectees was highly deplorable, rather it was gloomy. The Association claimed that Government of Punjab has not yet been able to bring more than 300 substitutes on road. Even these have badly failed. So much so that Bank of the Punjab has stopped issuing loans on rickshaws on the basis that newly manufactured 4-stroke CNG rickshaws have totally failed on the road. The reasons of their failure given by the Association are as follows:

- (1) The Department of Transport and others including even new manufacturers does not understand the technology well and it has not bothered to involve those who are insiders. The result is that they have fitted only one cylinder in the engine for total pressure of CNG (32Kg) that should have been distributed in four cylinders as it does in cars at the rate of 8Kg per cylinder for smooth ignition and combustion.

- (2) The equipment in the CNG rickshaws is substandard whose make is Chinese. For example, its timing chain is 1/10 Th of 2-stroke, and carburettor is also not up to the mark.
- (3) CNG 4-stroke rickshaws are more expensive than 2-stroke rickshaws for different reasons: (1) Its spare parts, in the first instance, are not available. If these are available, they are very expensive. For example, the price of the clutch wire fitted in two-stroke rickshaws was Rs 5, while that of CNG 4-stroke rickshaw is Rs 250. Similarly, the clutch box of 2-stroke rickshaw costs only Rs 60 to 70 while that of CNG 4-stroke rickshaw costs Rs 3,000. Another example may be the piston of two-stroke that costs Rs 200 while that of 4-stroke costs Rs 2,500. Moreover, the four stroke engine can be overhauled in Rs 600 to 700, while that of four stroke demands Rs 5,000 to 6,000 for overhauling.
- (4) This is unfortunate that no dealer, technician or mechanical engineer was consulted and those who were involved were not aware of the in depth technology.

We discussed the authenticity of first reason advocated by the affectees with technical people as our first impression about the stakeholders was that most of them were not clear about the difference between two stroke and 4-stroke technology. The fact is that the gas pressure in all the cylinders even in cars is the same as every cylinder acts as an independent engine. The number of cylinders is increased to increase the overall engine capacity. The car engines contain four cylinders as their engine capacity is 800 to 1000 CC. Thus, rickshaw being 150 to 250 CC, even one cylinder may be sufficient. Of course use of two cylinders may be better. The heating up of new CNG rickshaws, thus, may be due to some defects in the design. Although, all the manufacturers claimed that their products are successful with one cylinder, the only Company that claimed success was the producer of WESPA. They claimed that their rickshaws were successful with the use of two cylinders. This Company is yet in the primary stage in new transaction. Let us see how it fairs in future.

The lack of standard in Chinese products due to overproduction stated in second reason can be acceded to in the light of many other products whose performance is substandard. An important example in this context is electrical fittings. We do not agree with the third reason because none including manufacturers, drivers in India and Pakistan endorsed it. The prices of substitutes were overstated rather exaggerated, For example, the price of the clutch wire told by the sellers was between 18 to 35 rupees. About last reason, the claim of government departments constitutes the opposite. They say that we have taken the expert advice at every step forward.

The major argument that members of Association offered was that due to this failure the Bank of Punjab has stopped issuing loans to CNG rickshaw buyers. This could be verified by contacting different branches of the Bank. The one that will better illustrate is located in LDA Plaza. We contacted the bank officials who said that it was true that the bank had stopped issuing loans but the reason was not as narrated by the Association. The stoppage was due to the unsatisfactory return of the loans from the rickshaw buyers.

Our experience of exchanging ideas with Indian rickshaw drivers also did not present an encouraging picture. Most of them did not interpret substitutes as successful

vehicles. They also endorsed that these get heated when moving uphill. They also said that the old rickshaws were more powerful than the new rickshaws. Although the substitution in Delhi is almost complete, we are not hopeful about its effectiveness in Pakistan and feel that confidence expressed by government departments is in reality “Overconfidence”. This is evident from their number on road encountered by common man.

6.8. Available Options to Two-stroke Rickshaws

There were two major options before the controlling departments: Conversion of 2-stroke to 4-stroke CNG rickshaws and manufacture of new 4-stroke rickshaws. Government of the Punjab totally discarded the first option with verbal interpretation that the conversion is not economical. The same were the views of some new entrants in rickshaw manufacture in tune with the government policy. When they were asked if there was a sanction of some formal study behind this argument of negative economics, answer was “Yes” but where the study was lying and who did it?, there was no answer..

The association members were of the view that the conversion of two stroke to 4-stroke was possible within two hours per rickshaw with an investment of Rs 20,000 to 22,000. If the subsidy that is being paid to the Bank is paid to the rickshaw owners, the same could be accomplished without any problem. If the calculations are done on 60,000 basis, the government is prepared to invest Rs 8.6 billion national money on manufacture of four stroke rickshaws. The same can be managed in Rs 1.3 billion and a saving of 7.3 billion is visibly possible but Government is not trying to understand the idea and it is after big national wastage. One of the companies “Tiger” had actually converted at the above price that is Rs 22,000. When it was declared in the Court of Law, the Chief Minister’s Secretariat instructed to start action against the Company. There was the likelihood that factory of the Company may be sealed. On this basis the Association had lodged a petition in Lahore High Court.

We also feel that both options should have been techno-economically evaluated before resolving in favour of new manufacture only. After sorting out alternatives, the choice should have been for the most appropriate. The Government of the Punjab should have kept in mind that scrapping 60,000 to 100,000 rickshaws means big sum of money that could be saved. One of the manufacturers told us that they are considering conversion and have a plan to start it after a few months. Of course, they admitted that technology was new and conversion may be possible in Rs 60,000 to Rs70,000 per rickshaw.

6.9. Effect of Ban on Rickshaw Manufacturing Companies

The Rickshaw Dealers Association claimed that about 12 to 13 companies involved in two stroke rickshaw manufacture have closed after the ban. They could not survive due to lack of capital for shifting to new technology. Most of these companies were in Lahore. Of course, some had their head offices in other cities of Pakistan. These companies were Eagle Rickshaws, Ghori Rickshaws, Eagle Rickshaws, Super Star, Excel Car, Shaheen Rickshaws, Super Star (Lahore and Hyderabad), Wicky Master, Sitara Rickshaws, Shan Car, Sunghat Car, Kamal Car, etc. The average labour force in these companies was 100 to 150. If average taken is 125, then it will in all be 1300. If the

labour of survivors is included, total number of workers comes out to be 2,000. This figure was provided to us also by the Department of Transport also.

One of the companies said that their investment and overheads almost doubled with the Ban and thus it was very difficult for financially weak companies to survive.

6.10. Effectiveness of Financing Scheme of Punjab Government

The Chief Minister of Punjab has sanctioned Rs 20,000 out of the Green Fund as subsidy paid to the Bank, The rickshaw buyer will deposit Rs 24,000 and Bank will sanction a loan of Rs 100,000. This makes the overall price of rickshaw as Rs 144,000. The instalment to be paid by the buyer will be Rs 33, 00 per month. The interest will be paid by the Government.

The Association members were of the view that had Government paid subsidy to the rickshaw driver/owner instead of paying it to the Bank and conversion permitted, the matter would have crystallised with a meager investment of Rs 60,000×20,000 = Rs 1,200,000,000 or 1.2 Billion. This argument has an appeal if it is techno-economically proved that the conversion leads to technologically sound product and is economically viable with sanction of formal study behind it.

Here, it may be appropriate to narrate the information gathered from one of the rickshaw drivers. He told us that he had the impression per announcement that he will be able to get new rickshaw on instalment if he makes arrangements for Rs 23,000. He was successful in this exercise but when he contacted the Bank, he was told that including the taxes, he had to pay Rs 45,000 that he was not able to manage. He spent his saved money in routine needs and was left without a rickshaw. He also complained that those who purchase rickshaws on cash are on top priority. Very few are successful in purchase of rickshaws on instalment.

6.11. Challenges to the Transparency of Procedures at Different Levels

The dealers were of the view that the procedures followed by different departments at different levels were not transparent. They said that there were many activities that should have stopped after date of Ban Notification that is 22-12-2004, but continued even after that date. Some of these activities are yet going on.

CONCLUDING REMARKS

In our opinion, in spite of the long history of attempts of Punjab Government to control environment since early 1990s and inadequate responses of rickshaw drivers, dealers and manufacturers that constitute the major cause of failure of the control agencies in implementation of long acting Pakistan environment protection policies, we conclude with the following remarks:

- (1) The big boost to decision taken by the Punjab Government came from the decision of Supreme Court of Pakistan.
- (2) The ban was imposed without the sanction of a systematic techno-economic study that should have clearly crystallised out what would be its impact on the socio-economic status of rickshaw drivers, rickshaw manufacturing labour and all others aligned to rickshaw business that collectively make a highly significant number worth attention of all concerned.

- (3) The ban was imposed on the basis of vehicular air pollution policy templates of other countries particularly of India without taking into consideration the fact that no systematic study seems to have been carried out in these countries. Anyhow, our recent observation during our visit to India reveals that Indians apparently seem to have been successful in shifting not only from two stroke to four stroke CNG auto-rickshaws but also have affected this change in other vehicles such as buses, trucks, etc, in a short span of time since 2002. On the contrary, we have achieved very little on this front and chances of success in future also are not bright. The basic cause of this difference is that our conditions are very different from India. For example, barring our comparable nuclear capability, India is far ahead of us in routine technologies. Moreover, it is now equipped with well developed business, financial, economic and social institutions that are striving to achieve leadership at the global level. Above all, the temperament of Pakistani rickshaw drivers is entirely different from Indian rickshaw drivers. Our assessment about Indian rickshaw drivers says that even they have not mentally accepted this change.
- (4) This is unfortunate that we do not prepare the nation psychologically before implementing a change through some new policy. This is endorsed by taking any example from any other sector. The same is the case over here. There were some sincere group briefing efforts by the official of EPD and Punjab Department of Transport but no arrangements were made to convince rickshaw drivers that air pollution from two-stroke rickshaws was not only injurious to the environment but also to their own children. We, in our pre-test activity, attempted to convince them on these lines and the results were highly positive.
- (5) The proceedings of ban on bigger vehicles such as buses, trucks, etc, should have been started at the same time as that provides big reference to the rickshaw divers to argue against the ban.
- (6) The major cause of heating up of new CNG rickshaws and other faults seem to be the reason that the engine design was not adequately standardised. Thus, its standardisation needs immediate attention of the stakeholders.
- (7) We strongly recommend that a formal enquiry may be lodged to identify the labels of non-transparency of procedures on different stakeholders and appropriate actions may be taken to redress the grievances of those who are challenging the transparency of procedures at different levels.

In spite of the pitfalls highlighted above, we give big credit to Government of the Punjab that it has succeeded in managing almost complete consensus on the necessity of imposing the ban to keep Lahore environment clean.

Now, the question is: What next? Our enquiry leads to the juncture where we can resolve to look into the implications of banning two-stroke engine auto-rickshaws on the following lines:

- Evaluation of alternative options such as conversion of two stroke rickshaws to four stroke CNG rickshaws, manufacture of new four-stroke CNG rickshaws, substitution of rickshaws by taxis, etc and sorting out what is in the best interest of the nation and in that of the public at large.

- The assessment of benefits and costs of the ban on two-stroke engine rickshaws to bring to light the correct status of the government decision of imposing ban.
- Studying the impact of ban on the socio-economic status of the rickshaw drivers of Lahore.

Side by side, the studies on these lines may be undertaken on the transformation of large size vehicles from diesel to CNG based vehicles.

REFERENCES

- A Report from Dublin, Ireland. <http://www.enfo.ie/leaflets/bs13.htm>
- Air Quality in México: Toward Clean Air—in a Decade Report from México City Air Pollution Workshop, 13 April (2004) Mario Molina, Chair http://66.249.93.104/search?q=cache:5Wq8DTD4VL4J:www.cleantransportcouncil.org/documents/Molina_Mexico_Strategy_2004.pdf+Air+Quality+in+M%C3%A9xico:+Toward+Clean+Air%E2%80%93in+a+Decade,2004&hl=en&gl=pk&ct=clnk&cd=1
- Division of Public Health, EPA-US. Ozone's Impact on Health, Division of Waste and Air Management; Air Quality Management. ONREC Online http://www.dnrec.state.de.us/air/aqm_page/stopo3.htm
- Dockery, D. W. *et al.* (1993) An Association between Air Pollution and Mortality in Six U.S. Cities. *New England Journal of Medicine* 329, 1753–59.
- Environmental Protection Agency, USA. The Clean Air Act <http://www.epa.gov/air/caa/title2.html>
- Goren, A. and S. Hellman (1999) Impact of Vehicular Air Pollution on the Health of Children in Tel Aviv—Conducted by of the Tel Aviv University School of Medicine, in Cooperation with the Ministry of the Environment.
- Haider, G. (2005) Ban on Two-stroke Rickshaws may Hit 0.3m Punjab Families. The Daily Jang On-line March 3, <http://www.jang.com.pk/thenews/mar2005-daily/05-03-2005/metro/12.htm>
- IRIN (2006) United Nations Office for Coordination of Human Affairs. The Congested Streets of Lahore—Two-stroke Vehicles are the Worst Polluters. 3 April. http://www.irinnews.org/report.asp?ReportID=43590&SelectRegion=Central_Asia&SelectCountry=PAKIS
- Johnsen, K. (2001) Executive Director Orbital Engine Corporation. Regional Workshop for Reducing Vehicle Emissions Reduction of Emissions from 2-3. Wheelers5-7 September, Hanoi, Vietnam.
- Khaliqzaman, M. (2001) Consultant, Environment Team WB Dhaka Office Reducing Emission From 3-Wheeler 2-Stroke Engine Taxis in Dhaka, Bangladesh. Workshop on Reduction of Emissions, Hanoi.
- Khan, W. (2001) International Program Manager Department of Environment Government of Canada Ottawa, Canada Asian Development Bank Regional Workshop on Reduction of Emissions from 2-3 Wheelers, Hanoi, Vietnam.
- NIH News, National Institute of Health, USA <http://www.nih.gov/news/pr/mar2006/niehs-08.htm>
- Pope, C. A., *et al.* (2002) Lung Cancer, Cardiopulmonary Mortality, and Long-term Exposure to Fine Particulate Air Pollution. *Journal of the American Medical Association* 287,1132–41.

- Pope, C. A., *et al.* (1995) Particulate Air Pollution as a Predictor of Mortality in a Prospective Study of U.S. Adults; *American Journal Respiratory Critical Care Medicine* 151, 669–74.
- Rab, A. (2001) Assistant Director, Bangladesh Road Transport Authority DHAKA. Action Plans for Reducing Pollution from 2 & 3 Wheelers in Dhaka. Workshop on Reducing Vehicle Emissions Regional Workshop September 5. Hanoi.
- Rizvi, R. (2005) “The News” Centre, Punjab Split Over Ban on Rickshaws <http://www.jang.com.pk/thenews/mar2005-daily/04-03-2005/business/b19.htm>
- Roychowdhury, A. (2001) Centre for Science and Environment. Ban on Two-stroke Two-wheelers and Three-wheelers: The Environmentalists’ Viewpoint Action Plans for Reducing Vehicle Emissions Regional Workshop Reduction of missions from 2-3 Wheelers Hanoi, Vietnam (5-7 September).
- Sister Community Partnerships Fuel Efficiency and 3-Wheeler Prototype for the Future Partners, Owens Corning Automotive Solutions, Troy, Michigan, Owens Corning Application Development Centre, Bangalore, India, and Global Environment and Technology Foundation (GETF), Annandale, Virginia www.getf.org/ewebeditpro/items/O96F3466.doc
- SOS-Arsenic.Net Banning Rickshaw Rich Blaming Rickshaws for Traffic Congestion <http://www.sos-arsenic.net/english/environment/rickshaw.html>
- South Asian Network for Development and Environmental Economics. Health Impact of Vehicular Air Pollution: An Empirical Estimate from Dhaka, Bangladesh http://www.sandeeonline.org/research_guidelines/sandee/Health%20Impact%20of%20Vehicular%20Air%20Pollution....pdf
- State Bank News (2004) FAQ—Dhaka Urban Transport Project. Posted Dec. 13, 2004. <http://www.worldbank.org.bd/WBSITE/EXTERNAL/COUNTRIES/SOUTHASIAEXT/BANGLADESHEXTN/0,,contentMDK:20294129~pagePK:141137~piPK:217854~theSitePK:295760,00.html>
- Statutory, F, Dominici, D. Peng, M. Bell, L. Pham, A. McDermott, SL, Zeger, and J. M. Samet (2001) Fine Particulate Air Pollution and Hospital Admissions for Cardiovascular and Respiratory Diseases. *Journal of American Medical Association* 295, March.
- Tuladhar, R. (2001) Clean Energy Nepal: 2-Stroke Ban in Kathmandu. Regional Workshop for Reducing Vehicle Emissions: Reduction of Emissions from 2-3 Wheelers Hanoi, Vietnam. (September).
- Walsh, Asian Development Bank (2001) Impact of Fuel Conversion on Emissions from 2-3 Wheelers of Fuel Conversion on Emissions From 2-3. Wheelers. Regional Workshop for Reducing Vehicle Emissions: Reduction of Emissions from 2-3 Wheelers Hanoi, Vietnam. (September 5).
- Workshop Synthesis and Recommendations of Regional Workshop: Reduction of Emissions from 2-3 Wheelers 5-7 September 2001, Hanoi, Vietnam
- World Bank Integrating Gender into World Bank Financed Transport Programs: A Case Study on Bangladesh Dhaka Urban Transport Project, Prepared by Salma Chaudhuri Zohir (September 2003).
- World Bank (2003) Health Impacts of Outdoor Air Pollution. South Asia Urban Air Quality Management Briefing Note No. 11, (Feb).

World Bank (2005) Dhaka Urban Transport Project Transport Strategy Brief for South Asia Region (SAR) — August 2005 <http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/SOUTHASIAEXT/EXTSARREGTOPTRANSPORT/0,,contentMDK:20693382~pagePK:34004173~piPK:34003707~theSitePK:579598,00.html>

World Car FreeNetwork (2005) Save Dhaka's Rickshaws Dhaka's Rickshaws under Threat: Stop the World Bank's War on the Poor Press Release: Campaigners Achieve a Victory in Effort to Save Dhaka's Rickshaws (March 2).

Zaidi, SNA (2001).Education Campaign on Reduced Lubrication for Rickshaws in Pakistan. Regional Workshop for Educing Vehicle Emissions: Reduction of Emissions from 2-3 Wheelers Hanoi, Vietnam (September 5).