

Sustainable Transport Measures: Acceptance Rate in Lahore

A. Ajwad¹, L. A. Qureshi², M. Zahid³

¹University of Management and Technology, Lahore, Pakistan

²University of Engineering and Technology, Taxila, Pakistan

³Universiti Teknologi Petronas, Malaysia

¹ali.ajwad@umt.edu.pk

Abstract-Sustainability defined as development meeting needs of the present without compromising on the ability of future generations to meet their own needs, has become a wide area of study in Civil Engineering. It has particularly become important in the transportation sector as a result of non-renewable fuel depletion, energy insecurity, traffic congestion, air pollution, global climate change and so many other negative issues. Sustainable transportation aims to tackle all these issues while providing other advantages. Furthermore sustainability is steadily gaining more footholds in the construction industry and is now one of the main expected competencies in a Civil Engineer. This paper focuses on the economical implications of sustainable transport measures. Furthermore it focuses on user rating and acceptance of these measures and how that affects their economical repercussions. In this research, A questionnaire was come up with aim to monitor user acceptance and rating of sustainable transport measures in the city of Lahore. It was found that public transportation has a very high rating and user acceptance whereas car sharing has low user acceptance in Lahore region. The research uses the data on user acceptance and rating to evaluate the economical impacts of sustainable transport measures. From the user acceptance and rating, it can be concluded that congestion charging would have a positive economical impact if it was employed in the area. However it has to be reiterated that the survey only reflected the views and opinions of only a small percentage of the population. Sustainable transport measures have both positive and negative impacts, which are social, economical and environmental. However the positive impacts, as seen in this research outweighs the negative ones especially in terms of economical impacts.

Keywords-Sustainability, Economy, Congestion, Public Transport, Car Sharing

I. INTRODUCTION

Sustainability has become a wide area of study in Civil Engineering and the transportation sector so that

it is being incorporated into almost every design project [i]. Sustainability is defined as development that meets the needs of present without compromising on the needs of future generations. Hence the objective of sustainable development is to enable people to satisfy their basic needs and enjoy a better quality of life without compromising on quality of life of future generations [ii]. Furthermore, sustainability has become one of the most important and expected competencies of a civil engineer. In the world, it is necessary to embed sustainability into every construction project as it is one of those subjects that cannot be ignored any longer [iii].

A good transportation system enhances quality of life through increased access to health care, employment, education, recreation and a wide range of consumer goods [iv]. However the current transportation system has some negative impacts as well. The challenge of a sustainable transport development lies in minimising these negative impacts while offering strong transportation benefits at the same time [v].

Considerable amount of research has been done to study the affect of different parameters on sustainability of transport. Shaheen et.al; did a study in Canada and found out that between 15 to 29% of car sharing participants sold a vehicle after joining a car sharing program while 25 to 61% had delayed or forgone a car purchase [vi]. Similar sort of study in Netherlands showed that car sharing has brought about a 39% decrease in private vehicle ownership among its members [vi]. However it should be noted that car sharing activities are more limited in Asia. Although car sharing has a relatively high profile, it has had little influence on traffic. This can be seen clearly in Switzerland where even the successful effort being put into place generates only a few thousand trips a day. This accounts for less than 0.1% of the total trips made by the 7 million residents of Switzerland [viii]. It is certain is that the concept of car sharing has to be optimised and perfected if it is to be used in reducing congestion. Studies have shown that one shared car equals reduces about four to eight cars on the road as a result of the measure. Secondly there is reduced

parking pressure as a result of car sharing [ix].

Congestion charging as a sustainable transport measure was studied in London. It was found out that this measure improved traffic during course of day rather than just peak hours [x]. Traffic speed increased by almost 20% whereas congestion reduced by 30.5%. Analysis have shown that due to reduced congestion and improved traffic flow by the implementation of sustainable transport measures, Ambient pollution also reduced considerably and inevitably reducing the health hazards associated [xi].

Use of Public transport as a sustainable transport measure was implemented in Germany. As a result of increasing problems to sustainability, the German government sought to rejuvenate the public transport sector. This helped increase the quality of public transport in Germany and hence attracted more customers while increasing productivity, reducing costs and cutting subsidies [xii]. Another study showed that use of public transport instead of personal cars not only reduced travelling cost per person but also reduced traffic congestion due to reduced traffic load on roads [xiii].

II. PROBLEMS IN TRANSPORTATION

A. Congestion

Congestion plays an important role in providing sustainable transportation measures. This is so because congestion worsens motorised mobility. Increase in traffic congestion in city of Lahore is due to the lack of adequate and reliable transportation funding in addition to increased personal and freight movement. Especially in recent years, repair works on roads with proper detours, have worsened traffic flows. Congestion is a major issue if not tackled it can leave next generations without an adequate means of mobility. Therefore congestion plays an important role in terms of sustainable transportation and this congestion must be kept in mind while designing any transportation network time.

B. Local Air Quality

Local air pollution has steadily gone worst as a result of motorized vehicles' contribution. Almost 80% of vehicles in Lahore do not comply with Euro 4 Emission standards. These air pollutants, especially toxic ones, have various negative health impacts, which may include cancer, cardiovascular, respiratory or neurological diseases. The emission of nitrogen dioxide (NO₂) from transportation sources increases the risks of respiratory problems and may even reduce lung function. Also some of the gases emitted can help causing acid rain. Sulphur dioxide (SO₂) and nitrogen oxides (Nox), when released, form various acidic compounds in the atmosphere, which when mixed in cloud water form acid rain. Furthermore acid rain has various negative impacts on the environment as it

reduces agricultural crop yield and causes forest decline [xiv].

C. Fatalities and injuries

A high number of fatalities and injuries is a problem currently being faced in the transportation sector [xv]. According to a news report, 328 people died and more than 46000 suffered injuries in traffic accidents in Lahore [xvi]. Not only Lahore but this problem with fatalities and injuries is taken to be a global phenomenon so that authorities in countries all of over the world are concerned about it. From the reports "Global Burden of Disease" [xvii] and "World Health Reports- Making a Difference" [xviii], road crashes and accidents were placed at ninth place, out of a total of over 100, among the causes of death in 1990. Furthermore, the problem is getting worse as forecasts have suggested it will move up to sixth place by 2020 and "in terms of life years lost and disability-adjusted life years" will be in second and third places respectively if proper measures are not taken.

D. Ecosystem damage

Government policies in Pakistan have not considered adverse affects on ecosystem since the beginning. Lahore being the second largest city in the country and so is the traffic density in the city. It should be kept in mind that transportation activities can harm biological resources [xix] and generate a number of adverse environmental effects. These effects can be direct, indirect or cumulative. Studies have shown that the indirect effects may have grater impacts than the direct ones, but are not generally well understood [xx]. The effects can range from the death of a single animal to a complete loss of habitat. Hence it can be seen that some impacts are localised while others are more profound and widespread.

III. METHODOLOGY

This research focuses on congestion charging, public transportation, car sharing and car pooling as sustainable transport measures. In order to answer the questions being asked, a questionnaire was come up with. The aim of the questionnaire was to monitor user acceptance and rating of the aforementioned sustainable transport measures. Furthermore the information gathered will help to develop a study on their economical impacts.

The questions that the questionnaire aims to answer are as follows:

- How does the public perceive these sustainable transport measures?
- Would they be accepted if they are encouraged?
- What are the barriers preventing these measures from being adopted?

The questionnaire was used to gather this information instead of other means. The questionnaire

used was aimed at the general public; therefore it provides information on how the general public view and use sustainable transport measures. Furthermore it gives information on the acceptance level of sustainable transport measures and what needs to be done for there to be accepted if encouraged. The study comprised of a total of 100 questionnaires, out of which 60 were selected for data analysis as they were completely filled. Out of these 60, 36 were males and 24 were females.

The questionnaire was set to satisfy some of the indicators that were mentioned above. Firstly looking at the social aspects, it aimed to find out the user rating of sustainable transport measures. As was stated earlier this involves the overall user satisfaction of transport systems by disadvantaged users. Furthermore it was stated earlier that this data is limited and may require special collection, which the questionnaire aims to do.

However, some may question why user rating and acceptance of sustainable transport measures is important in regards to their economical evaluation. This is so because even if these sustainable transport measures are implemented, they need to be accepted by the public before they can make any headway. An example of this can be seen in congestion charging where the highway agency collects revenue from users, which is then used to compensate them with better infrastructure and the likes. On the other hand, if a lot of users change their means of transportation as a result of this measure being implemented, then enough revenue will not be collected. As a result the survey aims to collect the user rating and acceptance level of sustainable transport measures, which will then give an insight on their economical impacts if implemented.

It is also set to find out the commute time and employment accessibility of the general public. It is noteworthy that, as stated earlier, employment accessibility data is limited and requires special collection. They include transport diversity, mode split, travel costs, and affordability. Table I gives information about the indicators and their direction whereas Table II demonstrates the breakdown of sustainable transportation impacts.

TABLE I
ECONOMICAL INDICATORS OF SUSTAINABLE TRANSPORT MEASURES

Indicator	Direction
User rating	More is better
Commute time	Less is better
Employment accessibility	More is better
Land use mix	More is better
Electronic communication	More is better
Vehicle travel	Less is better
Transport diversity	More is better
Mode split	More is better
Congestion delay	Less is better

Travel costs	Less is better
Transport cost efficiency	Less is better
Facility costs	Less is better
Cost efficiency	More is better
Freight efficiency	More is better
Delivery services	More is better
Commercial transport	Higher is better
Crash costs	Less is better
Planning quality	More is better
Mobility management	More is better
Pricing reforms	More is better
Land use planning	More is better

TABLE II
SUSTAINABLE TRANSPORTATION IMPACTS

Economical	Social	Environmental
Traffic congestion	Social equity	Air and water pollution
Mobility barriers	Impacts on mobility disadvantaged	Climate change
Accidental damages	Human health impacts	Noise impact
Facility costs	Community cohesion	Habitat loss
Consumer costs	Community livability	Hydrologic impacts
Depletion of non-renewable resources	Aesthetics	Depletion of non-renewable resources

The questionnaire was given at bus stops as it is an area where a person might find a lot of people that use sustainable transport measures. It was short and concise so that people would not feel daunted to fill it up. The survey could have been made longer to reflect more data but it was made shorter so that it will not take too much of people's time. Attempt was also made to capture participants having personal cars but most of them were not interested in filling the questionnaires saying that local transport in Lahore is unreliable.

IV. RESULTS AND DISCUSSION

The three measures that were looked in this research for analysing of user acceptance of sustainable transport are congestion charging, car sharing and public transportation.

A. Congestion charging

In relation to congestion charging, most people who drive cars as their usual means of mobility gave reliability, speed and comfort as their main reasons. A question that needed to be asked them was whether congestion charging would be accepted by these drivers if it was implemented.

Even though it was stated that most people would

accept congestion charging if it was implemented, it is important to gather information on those that wouldn't as well. From the data collected it was known that most of the car drivers never shared a car on a regular basis. However a lot of them made it clear that they would use public transportation on a regular basis if some improvements were made. As a result, it can be assumed that most car drivers who get dissatisfied with their current means of transportation would change to public transport. This is very beneficial since public transportation is also classified as a sustainable transport measure.

B. Car sharing

In relation to car sharing, most of the people that filled in the survey did not car share. As a result, it was important to find out why they didn't. Most of them did not do it because it would reduce their flexibility and independence. Furthermore it was asked to them, what would mostly encourage them to car share. A surprisingly high number of people said that nothing would encourage them to car share. This brought about a dilemma in the encouragement of car sharing as a sustainable transport measure.

Car sharing clubs provide employment and business opportunities, which are positive economical impacts of car sharing. Furthermore, most members do not end up buying a car as a result of the cost savings, which such clubs provide. Therefore car sharing as a sustainable transport measure provides positive economical impacts on both a personal and public scale. Studies show that each car sharing vehicle replaces at least four to eight personal vehicles [xxi].

However, all these positive economical impacts are meaningless if the public do not accept car sharing and give it a high-rating [xxii]. As a result of this negative perception towards car sharing, it would have a negative overall economical impact even if it was employed.

On the other hand, most people would be willing to share a car as passengers. Nevertheless this would not make much difference since you need car drivers before you can car share. The following pie charts show the responses of people asked about car sharing. When asked about why they use car as their mode of transport, the response was mixed as shown in Fig. 1.

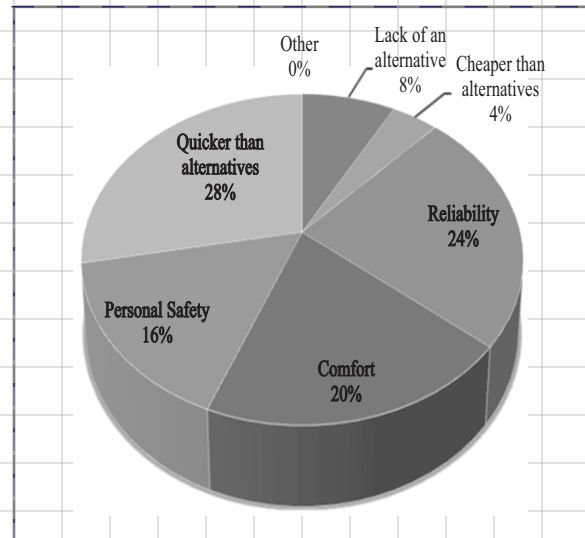


Fig. 1. Reason for using car as a method of transport

Next pie charts show the dispersion of opinions when asked about car sharing.

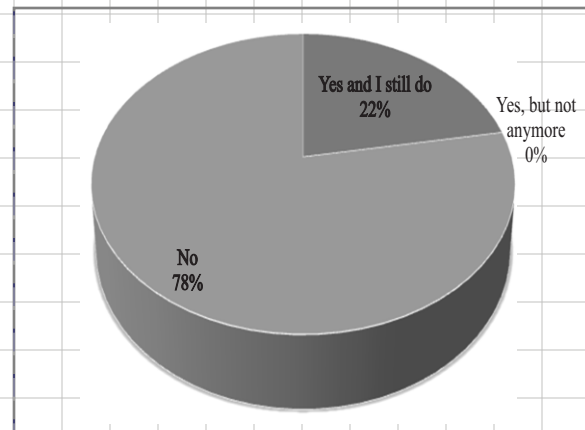


Fig. 2. Car sharing

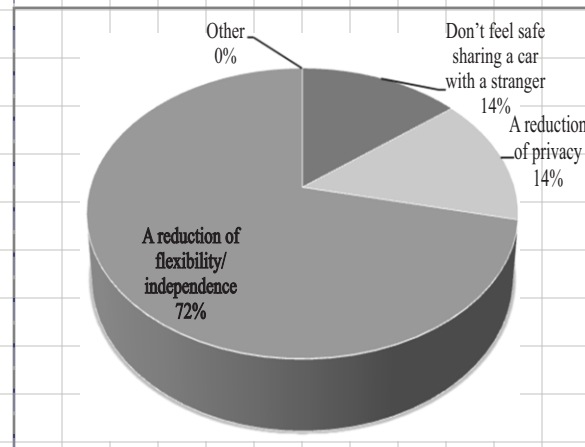


Fig. 3. Reason for not sharing car

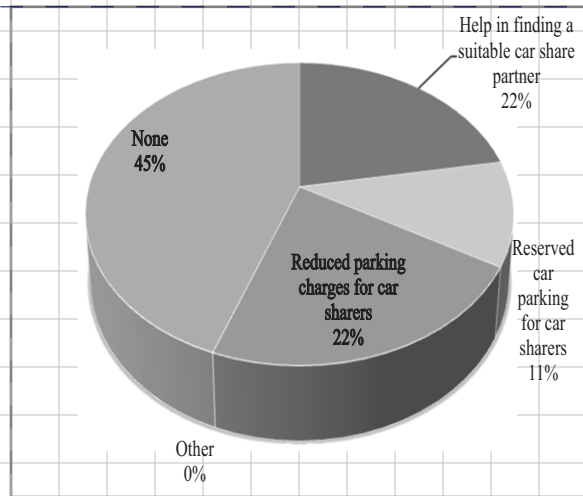


Fig. 4. Encouragements to car share

C. Public transportation

From the data collected in the survey, public transportation proved to be the most popular and common means of mobility. Most of the people who use public transportation do so because it's cheaper than other alternatives while a very high number do so because they do not have other alternatives. It was important to monitor the satisfaction level of public transport users. In relation to adherence to schedule times of public transport, most of the users were neutral. However, a surprisingly high number was satisfied with this. In relation to safety, most of the users were either neutral or satisfied. The next few Figures demonstrate the public response when asked about public transportation.

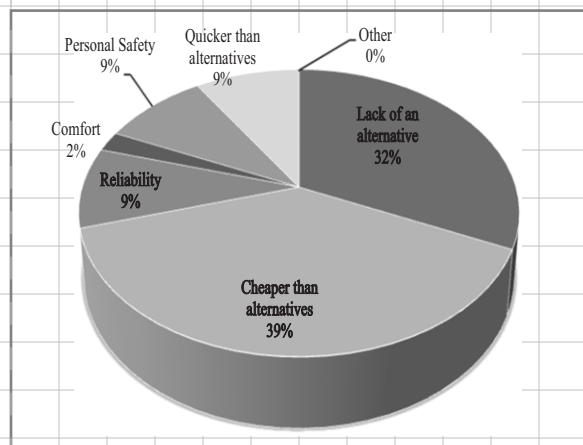


Fig. 5. Reason for using Public transport

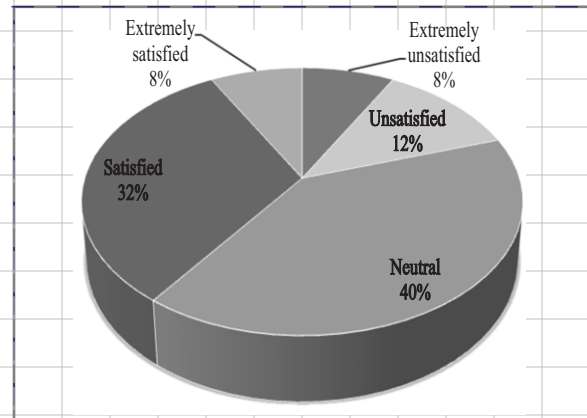


Fig. 6. Satisfaction with adherence to scheduled times by public transport

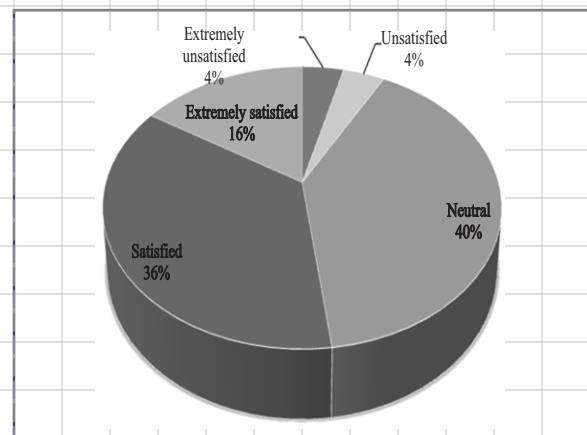


Fig. 7. Satisfaction regarding safety by public transport

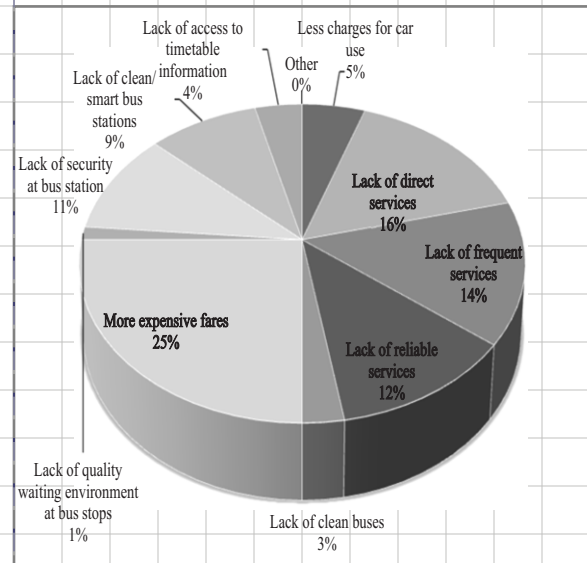


Fig. 8. Most discouraging factor about public transport

From the above impacts and effects, it can be seen that public transportation has a lot of positive economical impacts. Furthermore, as it is widely accepted, these positive economical impacts are optimised as it is encouraged. However, the survey provided information on factors that would mostly discourage people to use public transportation. From the public answers, the main factors are the more expensive fares and lack of direct services. At the end, it can be said that public transportation has an overall positive economical impact. Furthermore, since it has a high user rating and acceptance, it stands to reason that more people would flock to it, which in turn will maximise these positive economical impacts.

V. CONCLUSION

- The research has measured the user acceptance and rating of some of the most general sustainable transport measures in Lahore. It was found that public transportation has a very high rating and user acceptance whereas car sharing has low user acceptance in Lahore region.
- From the user acceptance and rating, it was concluded that congestion charging would have a positive economical impact if it was employed in the area. However it has to be reiterated that the survey only reflected the views and opinions of only a small percentage of the population.
- It was also found out that public transportation is the most popular and common means of mobility.
- Sustainable transport measures have both positive and negative impacts, which are social, economical and environmental. However the positive impacts, as seen in this dissertation, outweigh the negative ones especially in terms of economical impacts.

VI. RECOMMENDATIONS

As a result of the survey, several recommendations to improve in sustainable transportation were came given as follows:

- Encourage car sharing and to educate the general public more on it as there is a low user acceptance and rating of this sustainable transport measure.
- Provide help in finding a suitable car share partner as the public cited this as barrier for car sharing.
- Provide reduced car parking charges for car sharers.
- Provide reserved car parking for car sharers.
- Provide more direct services for public transportation.
- Provide annual season ticket loan for public transportation.
- Provide more frequent services for public

transportation.

- Provide adequate security at bus stops.
- Evaluation of economical impact of user acceptance of sustainable transport measures

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