ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

IJARCCE

International Journal of Advanced Research in Computer and Communication Engineering

PCON-2019

National Conference and Seminar on Innovations in Engineering & Technology

Govt Polytechnic College, Palakkad

Vol. 8, Special Issue 1, January 2019

Urban Resident's Awareness and Readiness for Sustainable Transportation a Case Study

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Abstract: Abstract-The present way of transport development in Kerala noted by over dependence on motor vehicles leads our state into a greater disaster in transportation system. Increased use of personal vehicles in areas where it is unable to afford proper transport facilities comes at heavy economic and environmental problems. With the number of vehicles on its roads increasing to unmanageable levels, Kerala is already in the pressure of transportation crisis. Unless adaptive and innovative measures are adopted, the State might find it is impossible to assign an efficient transportation system. A sustainable or green transportation system should control air emissions, traffic congestion, excessive fuel use, and it must consider the present and long term needs for the environment, economic growth and equity. Walking and bicycling have negligible environmental effects. However, they are affected by the environmental impact of motorized transport. Walkers and cyclist are turning to be a rare sight in the cities. The union government has claimed that it has taken many important steps to make public transportation system sustainable and environment friendly. Many projects aimed for more sustainable mobility are either not or only partially successful. Sustainable mobility needs substantial changes in individual travel behavior. This paper studies the willingness of an urban population to use sustainable vehicles and their readiness to reduce car usage and also the barriers and motivations to using sustainable transportation for daily trips by conducting a survey of vehicle users. Modes of sustainable transportation considered in this project are pedestrians, bicycle and public transportation. Distribution of the questionnaire will make from house to house and also approaching respondent at the recreation center, shopping centers etc., for the selected area.

Keywords: Sustainable Transportation, Questionnaire, Car Sharing, Cycle Tracks, Household Survey

I. INTRODUCTION

Development of road infrastructure has not kept pace with the rapid increase in the number of vehicles in Kerala. The number of all class vehicles in the State went up from 1,19,720 in 1975 to 36 lakhs in 2006. This was accompanied by increase in road length from 14,870 km to 21,347 km. Energy intensity of various transport modes is a key factor in determining transport related environmental impacts. Energy consumption per passenger km by bus is the least and is highest for cars among road based personalized vehicles. Public transportation provides more sustainable travel compared to other transport modes. But the sustainable mobility requires considerable changes in individual travel behavior. Road traffic has increased significantly over the years because most households today have access to two or more cars. In Kerala the average number of vehicles owned per family is two, and the average number of family members with driving license is also two. These figures indicate that virtually every family has a car and every family has more than one member with a driving license. The union government has claimed that it has taken many important steps to make public transportation system sustainable and environment friendly. Many projects aimed for more sustainable mobility are either not or only partly successful. Sustainable mobility requires considerable changes in individual travel behavior. Nevertheless, travel by private car remains the predominant mode of choice in major city centers. A number of studies have shown that some people might not always drive out of need, but because of choice. Car features provide a psycho-social value, which influences everyone to use a car rather than other modes of transportation. Therefore, the government should enhance transport policies that reduce the dependency and need to drive a car by providing alternatives other than driving.

Sustainable Transport is also known as Green Transport and it is any form of transport that does not use or depend on diminishable natural resources. Instead it depends on renewable energy rather than fossil fuels that have a finite life period. Because of this reason, there may be a little or a negative effect on the environment since it uses energy sources that are sustainable. Walking, cycling and sailing are best examples of sustainable transport. The sustainable

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transportation means "any sort of transportation vehicle or transportation habit that is environmentally friendly and doesn't emit toxic gases that could impact the environment and human health". A sustainable transportation system controlling air emissions, traffic congestion, excessive fuel use and balancing the present and long-term needs for the environment and economic growth.

II. LITERATURE REVIEW

Although no common accepted definition of sustainability, sustainable development or sustainable transport is available, it is generally accepted that sustainable development are, and more specifically, sustainable transport, implies finding a proper balance between environmental, social and economic qualities. A popular definition for sustainable transport was developed by the European Conference of Ministers of Transport (ECMT 2004), which stated that a sustainable transportation system is one that is accessible, safe, environmentally-friendly, and affordable.

This chapter provides an overview of previous research on sustainable transportation projects. It instigates the framework for the case study that contains the main focus of the research described in this thesis.

Many projects aimed for more sustainable mobility are either not or partly successful. Sustainable mobility requires considerable changes in individual travel behavior. One of the main reason of unsuccessful sustainable mobility project is the habitual character of individual travel behavior. The reduction of car use is a specific problem because the attractiveness of car is based on many variables associated with comfort, such as convenience, independence, flexibility, safety or privacy. These factors are studied by Nasrudin et al.[1]. They found that most of the respondents are considered driving a car as relaxing and safe and also stated that driving a car gave them freedom. This study examined willingness of people to switch to more sustainable vehicles, willingness to reduce car usage, willingness to switch to public transport etc.,

A modification for this study is done by Nasrudin et al[2]. This study analysed how transport policy measures have influenced travel behavior to stimulate sustainable transportation and the readiness of an urban population to reduce car usage. And they measured the respondent's readiness to reduce car use, readiness to reduce car speed and readiness to walk and cycle. Different variables tested in this survey includes the role of road pricing in travel behavior, role of parking fees in shopping venue selection, readiness to practice sustainable modes of travel and reasons why respondents do not like to walk or cycle. The results showed that increase in petrol prices would be a key factor to reduce travel and car usage and more provisions on public transport and affordable public transport fares would also encourage them to reduce car usage and opt for public transport.

Nasrudin et al.[3] conducted a study on "Barriers and motivations for sustainable travel behavior" in order to understand the barriers and motivations to using sustainable transportation for daily trips. The reasons for respondents are not motivated to use public transport are inefficient services and expensive fares. And the findings in this study are barriers and motivations to walk and cycle, Percentage of reasons why respondent do not like to walk or cycle, barriers and motivations to use public transportation and level of willingness to use public transport if the services are improved. And the main barriers and motivations to use public transport found in this study are punctuality problem, inefficient public transport services, expensive fares etc.

Abdullah,Y.A.,et al[4] are studied the willingness of an urban population to use sustainable vehicles and their readiness to reduce car usage. The number of cars owned and number of licenses held in the family, the emotion and perception of owning and driving a car, the level of readiness to reduce car usage are evaluated in this study. Results of the survey suggested that the majority were not ready to consider cycling and walking as alternative. Every family has a car and every family has more than one member with a driving license. And also they found that a car is seen as something that provides security from unwanted people and events, as well as providing convenience, reliability and capability to provide access to more destinations than public transport.

III. METHODOLOGY

Methodology provides theoretical analysis of the techniques used in the field of study. It encompasses the theoretical analysis of the framework of methods connected with a branch of knowledge. The methods section describes action to be taken to investigate a research problem and the rationale for the application of specific procedures or technique used to identify, select, process, and analyze in the formation applied to understanding the problem, thereby, allowing the

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reader to critically evaluate a study's overall validity and reliability. And this section describes how was the data collected or generated, and how was it analyzed.

Data collection is done by household survey. Household surveys provides information by sampling the homes where people live and then interviewing one or more persons at each home. Household surveys are the most common type because they offer a standard way of collecting information. A total of 384 respondents were selected for this survey, as a sample representing the total population of Thrissur city by using stratified random sampling method. Selected of the sample were calculated based on the total population which is of 315957 peoples, with 95% degree of confidence limit, and 5% of the margin of error. Survey is conducted by approaching respondent at their home for different sections in the city. Here for this survey, the sampling is done by using a survey software known as sample size calculator.

A. Sample Size Calculator

This Sample Size Calculator is a software and it can be defined as a public service of Creative Research Systems survey software. It can use to determine number of people you need to interview in order to get results that reflect the target population as precisely as needed. We can also determine the degree of precision we have in the existing sample. Before using the sample size calculator, there are two terms that we need to know. These are: confidence interval and confidence level

B. Sample Size Calculator Terms: Confidence Interval & Confidence Level

The confidence interval commonly known as margin of error, can be defined as the plus-or-minus figure commonly reported in newspaper or television judgement poll results. The confidence level describes how sure we can be. Confidence level represented as percentage and defines how often the true percentage of the population who provide an answer falls within the confidence interval. The 95% confidence level means it will be 95% certain; the 99% confidence level means it will be 99% certain. Most researchers use the 95% confidence level.

The data used for the sampling are:

- Total population =315957 persons (From census data 2011)
- Confidence level =95%
- Margin of error =5%
- Sample size needed =384

Results obtained from the sample calculator for the given population is as shown in the Fig.1.

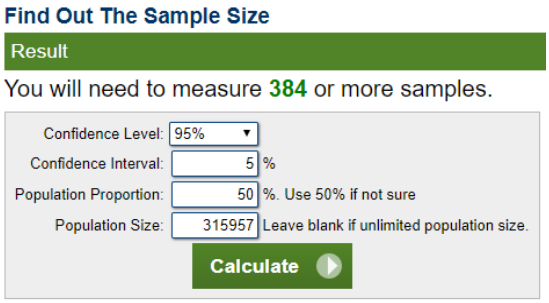

Fig. 1 Sample size calculator

The following table (Table.1) also represents sample size required for different population ranges

Table 1: Sample Size for Various Population Ranges

	Confidence level=95%			Confidence level=99%		
	Margin of error			Margin of error		
Population size	5%	2.5%	1%	5%	2.5%	1%
100	80	94	99	87	96	99
500	217	377	475	285	421	485
1,000	278	606	906	399	727	943
10,000	370	1332	4899	622	2098	6239
100,000	383	4513	8762	659	2585	14227
500,000	384	1532	9423	663	2640	16055
1,000,000	384	1534	9512	663	2647	16317

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ISSN (Print) 2319-5940

IJARCCE
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PCON-2019
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From this table sample size required for a population of 315957 and 95% confidence level with margin of error 5% is 384.

IV. DATA ANALYSIS

After data has been gathered, it is to be presented in such a way that it communicates the information and enables conclusions to be drawn. Accurate and appropriate ways of representing data were chosen out of the several ways of data presentation. The several ways of presenting data include tables, pie charts, bar graphs and line graphs, only tables, pie charts and bar graphs were used in this research. The purpose of the discussion is to explain and to report the importance of our findings in light of what was already known about the research problem being explored, and to explain any new understanding about the problem after taken the findings into consideration. This chapter presents the results of the data analysis and discussion of the results.

A. Car Ownership and Driving Licenses Held in A Family

Table 2 shows that, the average number of vehicles owned per family was two and the average number of driving licenses belonging to a family was also two. These numbers show that virtually every family has a car and every family has more than one member with a driving license.

Table 2: Number of Vehicles Owned and Driving Licenses Held in a Family

Number of vehicles owned in the family	Total	Percentage (%)	Number of driving licenses held in the family	Total	Percentage (%)
0	28	7	0	26	7
1	108	27	1	111	28
2	158	40	2	149	37
3	70	18	3	81	20
4	26	6	4	22	5
5	8	2	5	7	2
			6	2	1
Total	398	100		398	100

B. Emotions and Perceptions Toward Car

From the conducted interviews with car owners and non-car owners to investigate the psycho-social benefits to people which is obtained by using cars, it is found that a car is seen as something that provides convenience, reliability, and capability to provide access to more destinations than public transport. In the current study, when asked how they generally felt while driving their cars, the majority of the respondents provided positive feedback. Most considered driving a car gave them freedom and they considered driving a car as safe and relaxing than other public transportations.

Table 3: Percentage of Various Emotions Felt When Driving a Car

Statements	Total	Percentage (%)
Freedom	186	33
Relaxing	164	29
Safety	115	21
Stressful	39	7
Tiring	40	7
Troublesome	17	3

From table 3 and fig 3 respondents stated that driving a car gave them freedom and considered driving a car as relaxing and safe

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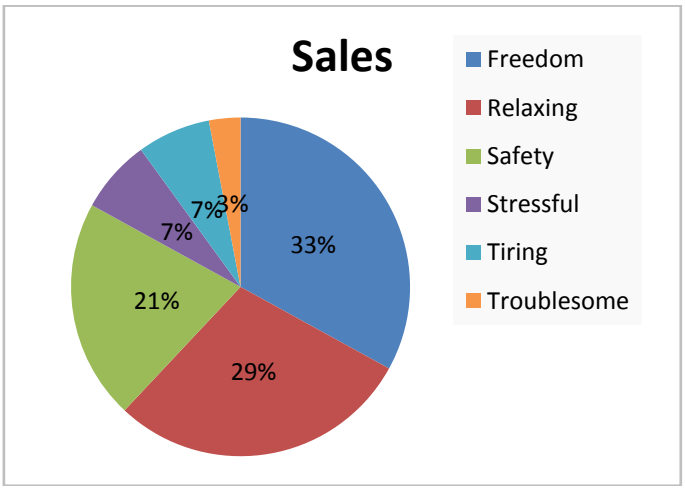

Fig.2 Percentage of various emotions felt when driving a car

C. Willingness to Switch to More Sustainable Vehicles

Lensink (2005) concluded that obtaining a more sustainable transport system requires that more attention should be paid to the interaction between infrastructure planning and traveler's decision behavior. The research of Boarnet and Sarmiento and Cao et al. suggested that residents of a new urbanist area were more willing and able to take public transport, walk, or cycle to their destinations, due to their own personal beliefs and philosophies on transport and the environment.

D. Willingness to switch to walking or cycling

Walking and cycling are the two modes of transport which are available to nearly everyone, produces almost no emissions, promote fitness and health and make the minimum impact on the local environment.

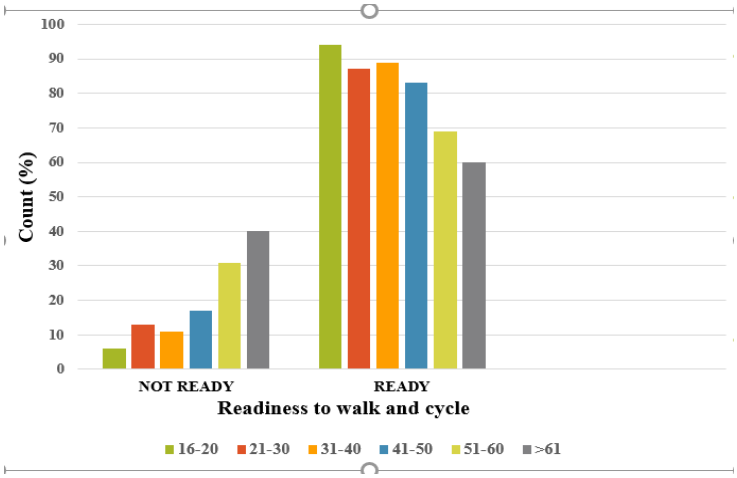

Fig.3 Willingness to switch to walking or cycling

The study found that majority are willing to cycle or walk as alternatives to using a motor vehicle.

In general, younger generations tend to be more concerned about environmental quality than older generations. Hence the younger generations are considered more open to environmental issues than older generations. In this study, the results show that the younger age group (16-20) recorded the highest result in showing ready to walk or cycle. And the older age group (greater than 61) recorded the highest in showing not ready to walk or cycle.

E. Level of willingness to switch to use public transport by gender

The current study examined the level of willingness to use public transport by gender. Table represents willingness of people to use public transport.

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Table 4: Level of Willingness to Switch to Use Public Transport by Gender

Gender	Willingness to use public transport		Total
	Not ready	Ready	
Male	20	185	205
	9.8%	90.2%	100%
Female	12	181	193
	6.2%	93.8%	100%
Total	32	366	398
	8%	92%	100%

From this table we can see that female respondents were shown to be more ready to use public transport compared to males. And overall 92% respondents are ready to use public transport and 8% of respondents are not ready. Which means that women were found to be more willing to reduce their car usage, more positive towards reducing the environmental impact of travel modes, and more positive towards ecological issues than men.

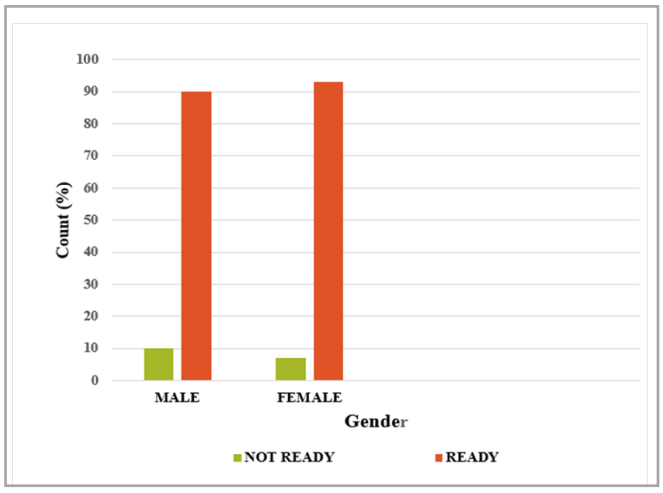

Fig.4 Level of willingness to use public transport by gender

F. Mode of Travel to Work

The objective of this stage of the analysis was to identify association between different modes of travel to work. The Figure 4.4 reveal the main modes of transport by which residents get to work.

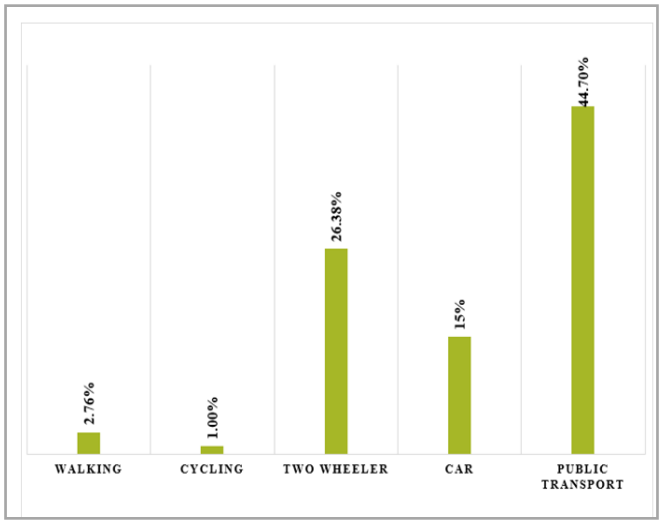

Fig.5 Mode of travel to work

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The results of this study showed that 44.70% of respondents use public transportation to commute to work compared with 26.38% who use car and 15% who use two wheelers. To encourage residents to support a sustainable transportation program, the respondents were asked to provide an opinion on the factors that would reduce the use of cars. The respondents were given several statements on options would motivate them to reduce car use.

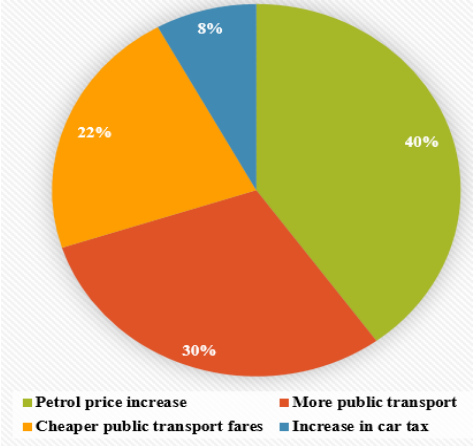

Fig.6 Reasons causing car use reduction

Majority stated that the increase in petrol prices would be a key factor to reduce travel and car use. Other than that, more provisions on public transport and affordable public transport fares would also encourage them to reduce car use and opt for public transport as the main mode of travel.

G. Mode of travel to personal trips

The objective of this stage of the analysis was to identify association between different modes of travel to personal trips. The Figure 4.6 reveal the main modes of transport by which residents get to personal trips.

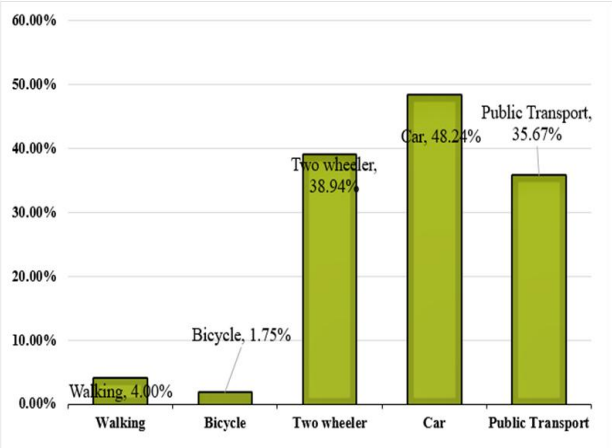

Fig.7 Mode of travel to personal trips

From the figure () most of the respondents use car (48.24%) to commute to personal trips compared to 38.94% who uses two wheelers and 35.67% who uses public transport.

H. Reasons for not using public transportation

Public transportation is transport of people by group travel systems available for use by the general passengers, typically managed on a pre-determined time schedule, operated on established routes, and that charge a posted fee for each trip. Example of public transport include city buses, passenger trains etc. But the use public transport decreasing day by day and the reason for this decrease in use of public transport is analyzed in this section and the percentage of various reasons are provided in the table 4.4.

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Table 5: Reasons for Not Using Public Transportation

Reasons for not using public transportation	Total	Percentage(%)
More comfortable using the car	168	42
Loss of time waiting for public transport	94	24
Public transport is not efficient	50	13
Expensive fares	35	9
Others	26	7

Table 3 shows that, 42% of respondents stated that they were "more comfortable using the car". This was followed by the second highest reason, "loss of time waiting for public transport". Among the reasons respondents refuse to use public transport are punctuality problem, inefficient public transport services, and expensive fares. In this study, we have identified several barriers in using public transport. When respondents were asked their reason for not using public transport, 42% of respondents stated that they were "more comfortable using the car". This was followed by the second highest reason, "loss of time waiting for public transport". Among other reasons included inefficient public transport and expensive fares.

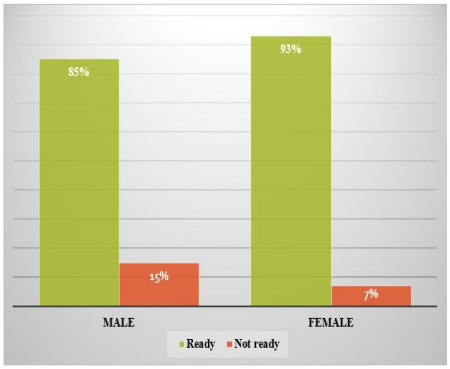

Fig.8 Willingness to use public transportation if the services are improved

However, the current study also found that the majority of respondents are willingness to use public transport if the services are improved. The improvement in public transport system would motivate them to use public transport as alternative to using a private vehicle.

I. *Readiness to adopt cycling*

Walking and cycling are the two modes of transport which are available to nearly everyone, produces almost no emissions, promote fitness and health and make the minimum impact on the local environment. This section analyzes the readiness of urban population to adopt cycling if excusive cycle tracks are provided. And the percentage of readiness of people to adopt cycling is presented in the following Figure (Fig 4.8).

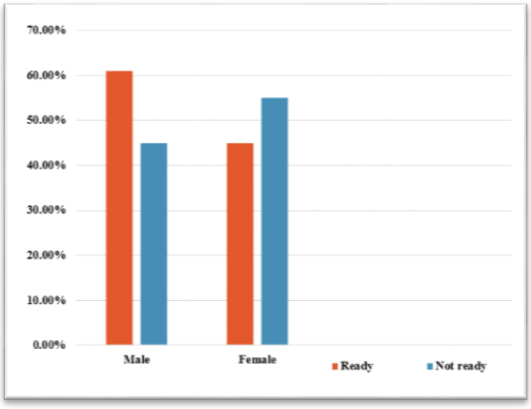

Fig.9 Readiness to adopt cycling, if exclusive cycle tracks are provided

ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

IJARCCE

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PCON-2019

National Conference and Seminar on Innovations in Engineering & Technology

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From the Fig 4.8, it is clear that most of the respondent are ready to use cycling, if exclusive cycle tracks are provided. This analyzes shows that male respondents are more ready to adopt cycling compared to that of females. About 60% of male and 45% of females are ready to adopt cycling.

J. *Readiness to use car sharing*

Car sharing is the practice of sharing a car for regular travelling especially for commuting.

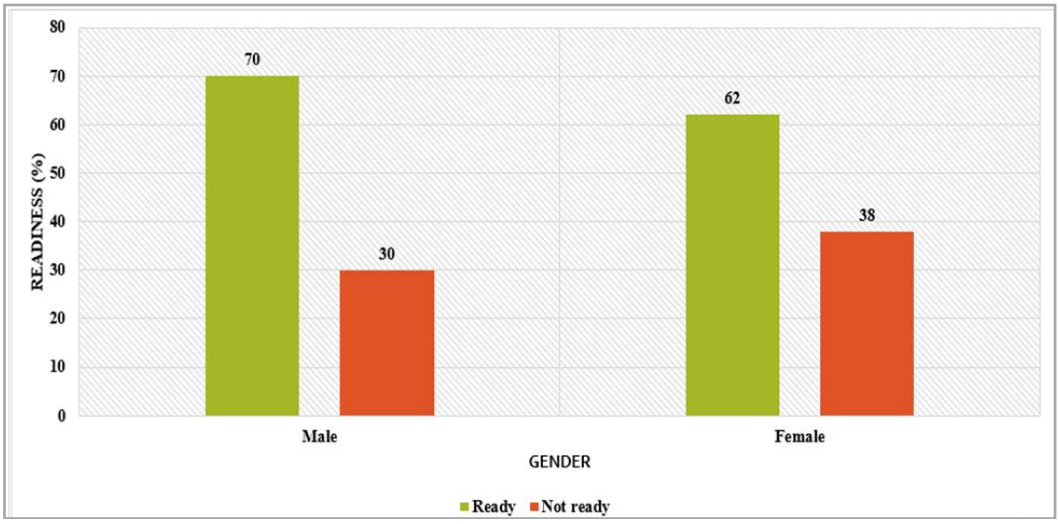

Fig.10 Readiness to use car sharing

The study found that the majority are willing to use car sharing. Male are more ready to use car sharing (70%) compared to females (62%).

K. Readiness to use share auto services (at least up to 7km)

Share auto is the practice of sharing auto rickshaws for regular travelling especially for commuting. This study tested the readiness of respondents for using share auto services and the results shows that majority are ready to adopt share auto services. In which females are more ready to use share auto services compared to males. About 82 % of females are ready to use this services compared to 67% males. About 33% males are not ready to use share auto services as a mode of travel.

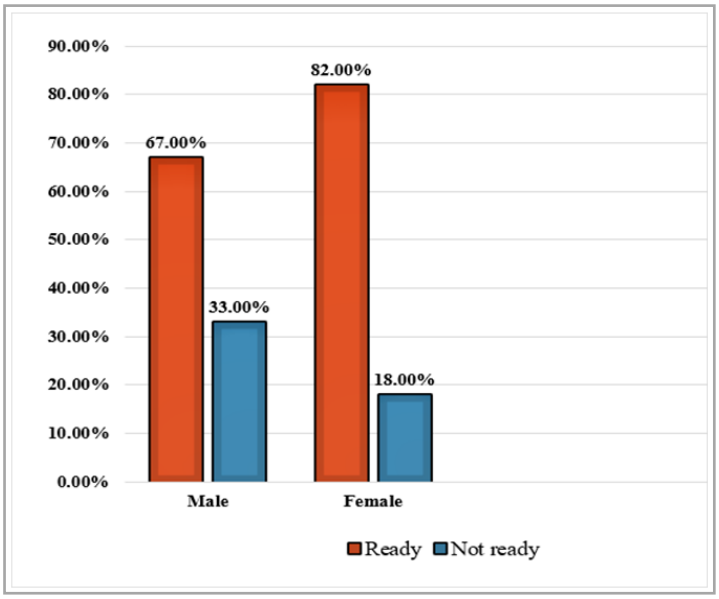

Fig.11 Readiness to use share auto service

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PCON-2019

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V. SUMMARY

The willingness of an urban population to use sustainable vehicles and their readiness to reduce car usage and the barriers and motivations to using sustainable transportation for daily trips are studied in this project by conducting a household survey of urban population. This study indicates that the majority of the respondents are ready to consider cycling or walking as alternative modes of travel and most of the residents are depend on their car and two wheelers. The habitual character of daily mobility is seen to be a major barrier for changes towards a more sustainable behavior. Other general conclusions obtained from the study are

- The average number of vehicles owned per family was two and the average number of driving licenses belonging to a family was also two. These numbers show that virtually every family has a car and every family has more than one member with a driving license.
- Most considered driving a car gave them freedom and they considered driving a car as safe and relaxing than other public transportations.
- The study found that majority are willing to cycle or walk as alternatives to using a motor vehicle. Younger age group (16-20) recorded the highest result in showing ready to walk or cycle
- Petrol price increase is the main factor which causes car use reduction and provision of more public transport facilities also reduces car use
- If proper cycle tracks are provided, it will encourage people to use bicycles as a convenient mode of transport, especially for short trips
- Most of the respondents are ready to use public transportation, if services are improved
- Willingness to use sustainable modes of travel is depending up on age, gender, vehicle ownership etc.,

VI. CONCLUSION

Road traffic has increased significantly over the years because most households today have access to two or more cars. A number of studies have shown that some people might not always drive out of need, but because of choice. Car features provide a psycho-social value, which influences everyone to use a car rather than other modes of transportation. The willingness of an urban population to use sustainable vehicles and their readiness to reduce car usage and the barriers and motivations to using sustainable transportation for daily trips are studied in this project by conducting a household survey of urban population. This study indicates that the majority of the respondents are ready to consider cycling or walking as alternative modes of travel and most of the residents are depend on their car and two wheelers. The habitual character of daily mobility is seen to be a major barrier for changes towards a more sustainable behaviour.

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