

Research Paper

Analysis The Potentials and Barriers of Applying Flexible Ridesharing Method in Southern Expressway in Sri Lanka

Chamodhi S. Bandara and Nadeeshani K.N. Silva*

Department of Agricultural Economics, Faculty of Agriculture, University of Ruhuna, Kamburupitiya, Matara 81000, Sri Lanka

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Abstract

The ridesharing arrangement means the transportation of persons in a motor vehicle when such transportation is incidental to the principal purpose of the driver, which is to reach a destination and not to transport person for profit. Internet based ridesharing is the method that allows individuals in need of transportation to access a pool of drivers through a mobile app. The research aim is to find out the potential of applying internet based ridesharing in Sri Lanka under three main objectives; to ascertain the problems of the current transportation system available in Southern Expressway, to analyze the commuters' perception towards the internet-based ridesharing concept and to examine the potential barriers and constraints of application of internet based the ridesharing system in Southern Expressway. Accordingly, data is collected using three samples representing 30 commuters from each group; the public bus users, personal vehicle users, and arranged hired vehicle users who are frequent commuters of the Southern Expressway. According to the research findings, the majority (90%) of the commuters use Southern Expressway to travel their work place and perceive travel cost as fair cost in contrast to time. The majority of the commuters' view is the availability of buses in Southern Expressway is not at a satisfactory level. More than 90% said Southern Expressway is much comfortable to travel. The majority of the commuters (85%) willing to use the ridesharing if it is available for Southern Expressway. More than 90% have internet access and therefore the application is not much difficult to implement in Sri Lanka. Even though, people are willing to use ridesharing application, there are some barriers have identified through this study such as gender issues, social status and fear to travel with strangers. Anyhow, research findings have shed green light to implement the ridesharing methods in southern Expressway despite of the prevailing barriers.

Keywords: Constraints, frequent commuters, problems and issues, ridesharing, internet-based

Introduction

The ridesharing arrangement means the transportation of persons in a motor vehicle when such transportation is incidental to the principal purpose of the driver, which is to reach a destination and not to transport a person for profit [1]. Internet based ridesharing is the method which allows individuals in need of transportation access a pool of drivers

through a mobile app. Over the past few decades, traditional ridesharing or carpooling/van pooling changes with technological advancement and also with the socio economic transitions in the world. When the times fuel cost is high, people tend to use more and more carpooling instead of using single occupancy vehicle usage. Anyhow, this carpooling indirectly paves the way to reduce traffic congestion on the road as well as reduce the CO₂ emission. Therefore, the government of America also gives their attention on this matter and provides subsidies to encourage people to use this ridesharing method [2].

Due to technological improvements of the world, the ridesharing being modified through mobile based applications by providing efficient time and cost management to the commuters. Therefore, in the last few years it becomes more popularized among commuters and numerous ridesharing service companies emerged all over the world such as Uber, Lyft and Side Car etc., [3].

Each rideshare company (also called Transport Network Companies) developed an app to download on smart phones to use when the passenger need to request a transportation. A passenger uses the app to request the type of service (i.e. tuk, minicab, Nano cab etc.) they want and their destination. The app uses the GPS on the passenger's smartphone to find out the current location and the nearest available driver. Once a driver is selected, the app displays the driver's name, license plate number and route. Likewise, the passenger able to track the driver's location and pick up the vehicle. Also passenger can share his or her ride with several other passengers and the travel cost will be shared among them. This ridesharing method is also called as ride hailing [4].

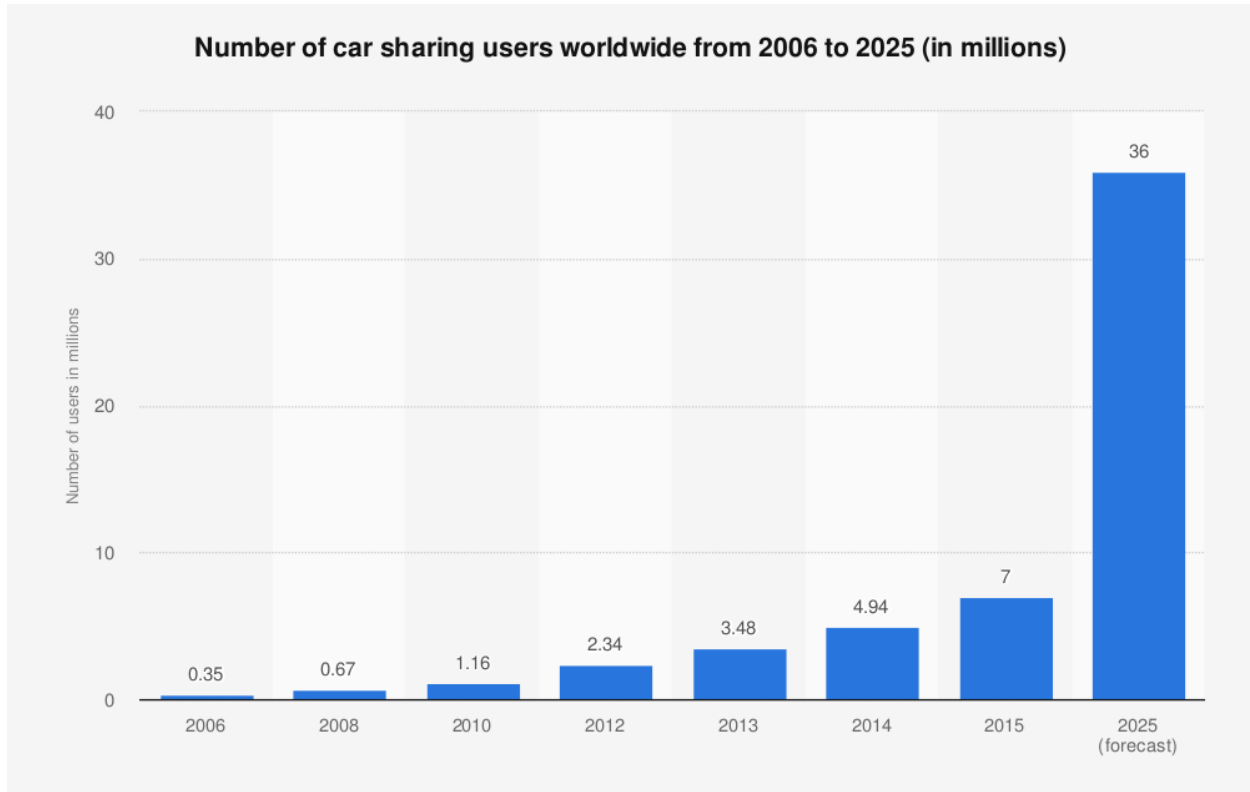


Figure 1: Global the ridesharing users present and future [21]

According to the above graph, nearly 40 million commuters in the world use the ridesharing method for their day-to-day transportation. This is a good improvement of the ridesharing application in the world as more people tend to use it not only to reduce their travel costs but also to reduce their carbon footprint.

As a developing country, we are still in an economic crisis and having poor economic development. In spite of that, our fuel and energy consumptions rapidly increasing while creating considerable traffic congestion on the road every day in many Urban areas in Sri Lanka [17]. In Sri Lanka, due to traffic congestion, massive financial and man hour loss resulted in every year. According to recent research, the daily economic loss to Sri Lanka due to traffic congestion in 2019 is estimated at Rs. 1000 million [15] and annual economic loss associated with the traffic congestion on the road is around the 397 billion rupees [14].

Poor road planning and high number of vehicle usage is the major problems to create these traffics especially in urban and suburban areas [5]. For many people, traffic congestion is an irritant because it throws their personal schedules in to chaos. However,

still government could not able to handle this problem. The major reason for congestion is demand on vehicle is greater than the supply of roads. The existing traffic congestion in Sri Lanka can be effectively managed through introducing more the public transport facilities, developing transport infrastructure facilities such as new roads, expressways, and railways and vehicle sharing facilities. Even though many of these transportations options have been implemented, there are some projects yet be implemented or are under the planning process [6]. Single Occupancy Vehicle (SOV) usage is very common in urban areas and mostly one vehicle uses only one or two commuters. Moreover, many of these SOVs are using daily routinized work mostly from work to home and thus has created huge traffic congestion every day in morning and evening hours in the urban areas.

Meanwhile, these vehicles emit CO₂ and other greenhouse gases to the air. It polluted the air and indirectly helps to global warming. The emission of CO₂ from the vehicle tailpipe depend on the amount of carbon include in the vehicle fuel. Usually, 99% of carbon release as CO₂ and 1% release as carbon monoxide (CO) and hydrocarbons [18]. The CO₂ emissions from transport (% of total fuel combustion) in Sri Lanka was 47.73 as of 2014. Its highest value over the past 43 years was 71.43 in 1986, while its lowest value was 45.89 in 2012 [17]

According to experts, in peak hour, the traffic congestion has created mainly around urban areas in Sri Lanka and peak hour traffic flow speed within city limits has reduced 32kmph to 6kmph. Furthermore, urban regions vehicles spend more than 2 hours to travel 20 km [19]. Moreover, this time lost worth is about 8.05 Million rupees [20]. Figure 2 shows the contribution of transport system for the country CO₂ emission. This figure shows the danger of using large number of SOV in the road in Sri Lanka.

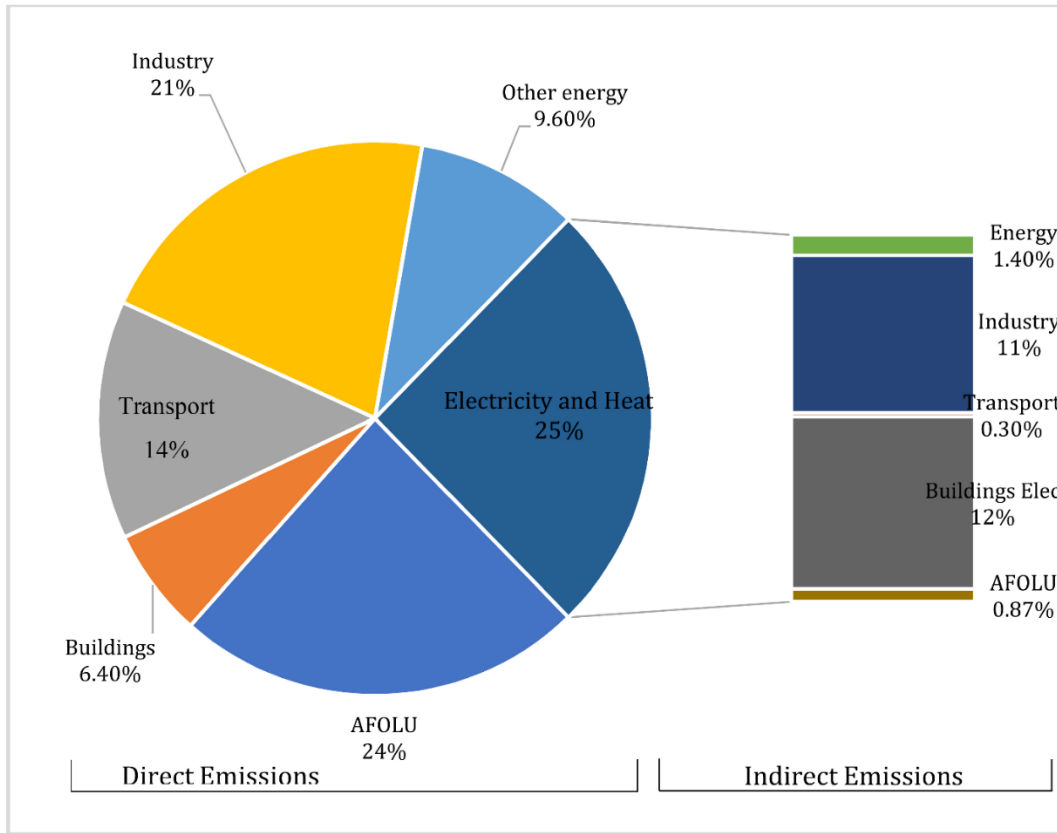


Figure 2: Sri Lanka CO₂ emission by transport and other sectors [13]

Among the alternative strategies taken by Sri Lanka government which have taken to mitigate economic lost due to traffic congestions, expressway introduced to the Sri Lankan transport system. At the beginning, Southern expressway was introduced to reduce travel time on the road. Mainly three types of commuters travel on southern expressway namely, the public transportation users, Personal vehicle users (car, van or any other vehicle) and Arranged hired vehicle users (mainly the office transport services). However, there are some common general issues have been identified when using Expressway by all of these commuters and which is underexplored by Sri Lankan context. Specially, personal vehicle owners have to bear high fuel cost and Vehicle Mile Travelled (VMT) while the public bus users are facing several issues such as high travel cost, inconvenient time schedules, lack of availability (weekends, off times and holidays), lack of convenience inside the buses (no resting time, Air Conditioning problems, noise disturbances etc.) [20]. However, all these challenges can effectively mitigate if we move to alternative traveling approaches under the concept of ecofriendly and cost effective

sustainable travel options. In such context, “travel ridesharing” can be an effective transport option for the frequent commuters of the southern expressway.

In context to energy conservation efforts faded in the 1980s and 1990s, transportation demand management also shifted and focus to improving congestion and air quality issues with the aid of telephone- and Internet-based ride matching programs. With the rise of the Internet, many the ridesharing systems took online forms, known as online ride matching. Developed, online ride matching services initiated around 1999. Since 1999, the private software companies began developing ride matching “platforms,” providing their suite of services to clients for a monthly fee [2].

The ridesharing provides so many benefits to the people as well as to the environment, the SMART 2020 report estimated that through these social network ride matching apps could reduce the carbon dioxide emission from 190 to 70 million metric tons per year [9]. By introducing organized dynamic, the ridesharing, we can reduce the number of vehicles on the road and through that reduce the traffic congestion. Even a small reduction of vehicle can decrease the congestion while increasing environmental quality in other hand [10].

This research aimed to explore the different problems in current transportation system in southern Expressway. the perception people have about this the ridesharing method and identify the potential barriers and constraints can be occurred under the ridesharing travel option. Therefore, this study mainly develops to analysis the commuters’ perception towards the internet based the ridesharing method in Sri Lanka. The major objectives of this study were to ascertain the problems of current transportation system available in Southern Expressway, to analysis the commuters’ perception towards the internet based the ridesharing concept in Southern Expressway and to examine the potential barriers and constraints of application of internet based the ridesharing system in Southern Expressway.

The findings of the research will address the existing issues of transport facilities in southern expressway and will evaluate the proposed ridesharing travel options in context of Sri Lanka. Further, this study will explore the societal perception towards this internet based ridesharing concept and potential issues and problem if it is opera ionized in future. Moreover, this study will show the new era for the existing transport system conserving time and environment. Furthermore, research findings may open up the new venue for the policy makers who deliberately neglected this issue.

Materials and Methods

Variables of the Study

The variables of the study have based on the past research studies and direct observation and information discussion made with the frequent travelers of the Southern Expressway. The main variables have categorized under the main objectives of the research. First the perception towards the available issues and problem of Southern expressway, current awareness of the commuters towards the ridesharing concept and possible constraints if the ridesharing applies in the Southern expressway.

Data Collection and Analysis

The target population of the study was the frequent commuters who used Southern Expressway. Due to the larger population size who use southern expressway frequently, this study has formulated three commuters' groups purposively. Sample 1; the public transport users who frequently use the public buses to travel in Southern expressway, sample 2; personal vehicle users who use their personal vehicles to travel in southern expressway and sample 3; arranged hired vehicle users who travel frequently by office transport buses or vans.

Purposive Sampling technique was used to collect primary data from each groups representing 30 from each groups. Pre- tested questionnaire used to collect primary data. Furthermore, data from sample 1 was collected from the frequent commuters who used Southern Expressway bus services from *Matara* to *Maharagama* . Data was collected at the morning and evening hours of the one week days. The time randomization technique practiced to reduce the sampling biases of the study. Data from sample 2 was collected from the commuters who rested at the *Welipanna* service area with the assumption of use of their own personal vehicles for the traveling purposes. The people who came to take refreshments were being the target population. Sample 3 data was collected using three office transport services travelled in Southern Expressway from *Matara* to *Maharagama*.

Results and Discussion

First, this study has analyzed the collected data based on the purpose of using southern expressway, prevailing issues and problem of using southern expressway. Then, the study has analyzed the perception of commuters towards the ridesharing concept and possible issues and challenges which might arise if the ridesharing concept applies in southern expressway.

Purpose of the Travelling in Southern Expressway

Based on the research findings, the majority of the public and arranged hired vehicle users were used Southern Expressway to travel their work place. In here, 70% of the public bus users, 57% of personal vehicle users, 97% of arranged hired vehicle users were travelled for their work place. Very few were travel for the business purposes and personal matters (7 % of the public users and 17 % of personal users). Therefore, the future application of the ridesharing method will be targeted these frequent travelers of southern expressway who are daily traveling to their working place.

Prevailing Issues and Problems of Existing Transportation Facility

The main three variables have used to explore the prevailing issues and problems of existing transportation options in Southern Expressway such as comfortability and time savings, availability of transport options, need of resting time while traveling on Southern expressway. Accordingly, the majority of the commuters’ have identified the Southern Expressway as the much comfortable and time saving in contrast to other routes. Interestingly, the majority of the public bus users (60%) perceived the comfortability of southern expressway only to some extend compare to other two commuters’ group (Figure 03). This has explained as the inefficient transportation plans of southern expressway at present scenario.

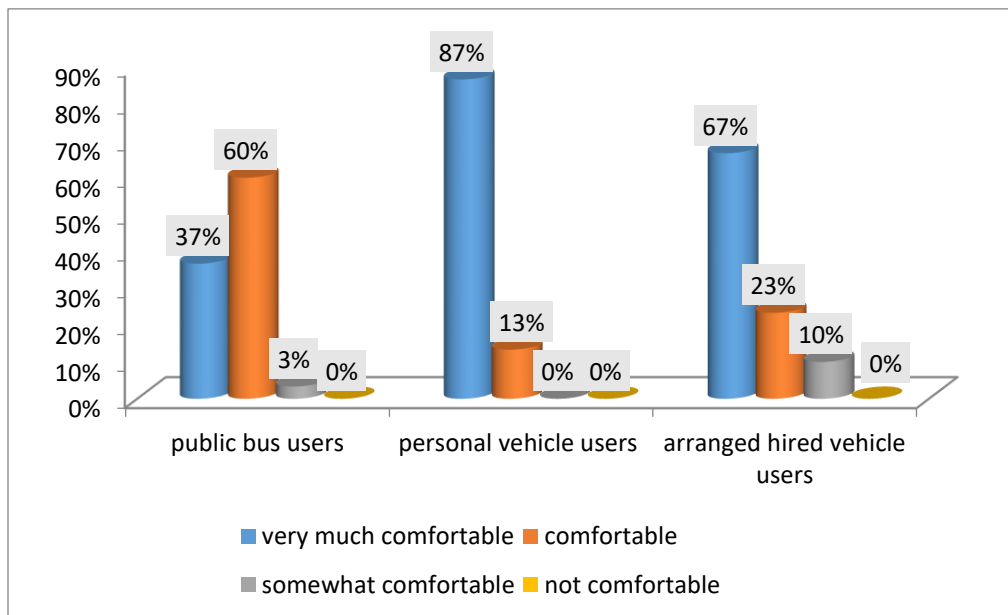


Figure 03: Comfortability of the Southern Expressway

Furthermore, study has focused to analyze whether the availability of the public buses in southern Expressway is sufficient for these frequent travelers. According to the research findings, 47% of the the public users and 50% of the arranged hired vehicle users were not much satisfied about the availability of buses due to many reasons. First, the main authority of the sourthern expressway buses is owened by the private sector which is targeting profict rather than functioning effectively for the betterman of the commuters. Therefore, commuters who travel daily to workplace are facing problems due to improper time management of the private ownership. Secondly, during the off times, availability of buses are very limited. So over time workers face a big problem when they back to home at night. They find alternative options such as hiring vehicle by a group of commuters who travel the same distances. Therefore, it shows the great possibility of applying the ridesharing method to those commuters as well.

The resting time while travelling is crucial for many commuters depending on the variety of reasons. Therefore, this study explored the perception of commuters of three groups towards the requirement of resting time while traveling (Figure 04). This resting time during traveling is required for the use of toilet, get some food and get relax according to their requirements. This time can be varied from 10 minutes to 30 minutes. Accordingly, 37% of the public bus users did not required resting time while travelling in southern expressway. In contrast, 35 % of arranged hired vehicle (45%) and 23 % of the public bus users considered resting time as an important factor. Furthermore, we analysis whether there is any difference of the perceptions of three different commuters' groups on available constraints in Southern Expressway. Kruskal Wallis test were used to analysis the statistical differences among these three groups. According to the Kruskal Wallis H test, there is a statistically significant different among the perceptions of three commuters' groups towards the travel cost and the comfortability of Southern Expressway. The interpretation of this test result was each sample have (the public bus users, personal vehicle users and arranged hired vehicle users) different opinions about these variables.

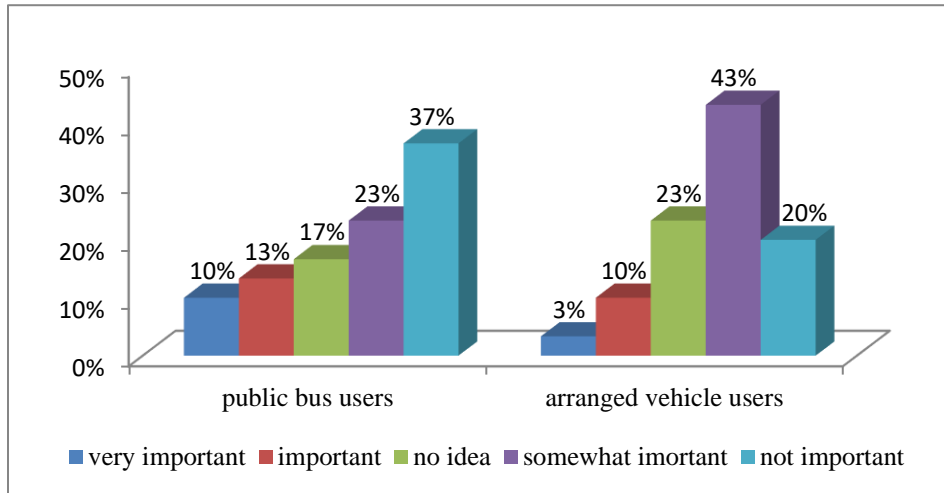


Figure 04: Importance of Resting time at the service area

Commuters Perception Towards the Ridesharing Concept

Furthermore, this study separately analyzes the commuters’ perception towards the internet based the ridesharing method in Southern Expressway in order to make implementation decision in future. Therefore, the perceptions of commuters towards the awareness about the ridesharing concept, the purpose of the ridesharing usage, available facilities to use the ridesharing and willingness to use the ridesharing if it is available in future, were analyzed.

Awareness about the Ridesharing Concept

Even though the Internet/mobile based the ridesharing is much popular in most of the developed countries, it is still a novel concept to many Asian countries including Sri Lanka. By proving this facts, this study also revealed that the all commuters’ awareness about this concept was not significant. According to the research findings, the majority of the respondents not aware about the ridesharing application before being asked about it. As a percentage 80% of the public bus users, 90% of the personal vehicle users and 80% of the arranged vehicle users heard first time about the ridesharing application as a transport mode.

The Intended Purpose of the Ridesharing Usage in Future

Furthermore, it was explored the commuters’ intended purpose if we use the ridesharing method in future in southern expressway. More specifically, the commuters have been

asked, what would be the reason they use it. The majority of the public bus users and personal vehicle users will be used the ridesharing to save their money. The majority of arranged hired vehicle users (63%) want to use the ridesharing to save their time. Very few commuters (5%) want to use this application to reduce their carbon foot print. Most of the respondents did not have idea about their carbon footprint and the conservation of the environment. They value this concept only by the economic aspects. Ride-sharing has the potential to yield significant economic and environmental benefits. Reductions in journey time and vehicle kilometers travelled (VKT), shared fuel costs, and decreases in emission, can all be achieved from encouraging ride-sharing application [11].

Available Facilities to Use the Ridesharing Application

Moreover, this study has explored the available facilities to use the ridesharing option in future. Basically, the ridesharing application will require the mobile phone, Internet facility and email address. Therefore, we explored whether these facilities are available for the selected commuters group. At present, almost all commuters trying to use and adopt mobile based applications in Sri Lanka. This gives us positive sign to introduce mobile based the ridesharing to the commuters who are having smart phones and email accounts. This study also revealed that the majority of the respondents were having smart phones and related facilities to use the ridesharing application in future. As a percentage more than 90% of the commuters used smart phones and email (Figure 05).

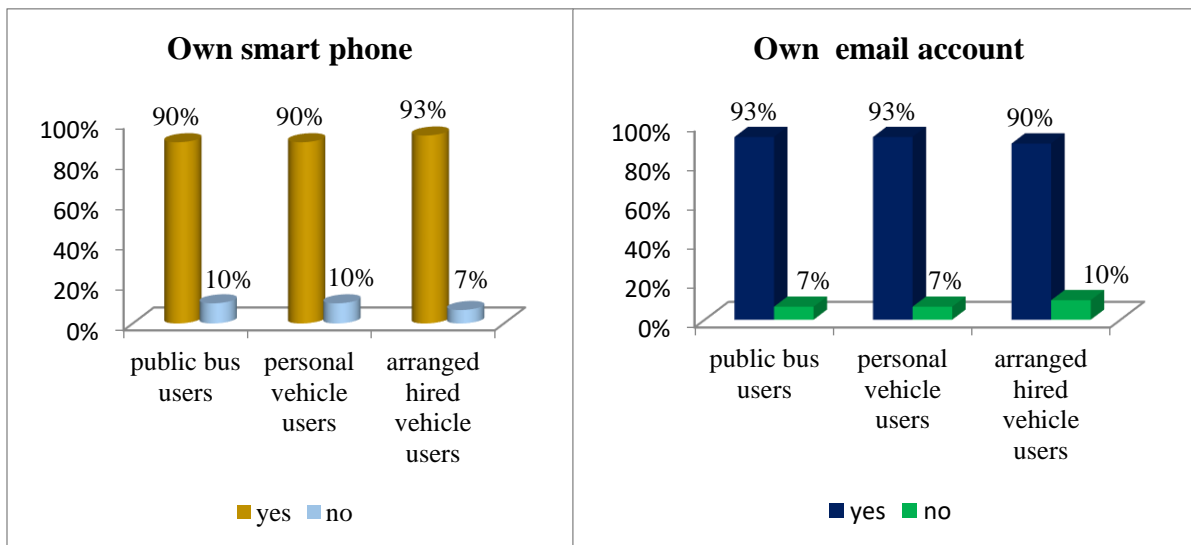


Figure 05: Available facilities to use ridesharing application in future

The growing ubiquity of mobile Internet technology has created new opportunities to bring together people with similar itineraries and time schedules to share rides on short-notice. Internet-enabled smartphones allow people to request trips whenever they want wherever they are, enabling dynamic, on-demand ride-sharing [9].

Willingness to Use Mobile Based the Ridesharing Method

Furthermore, these selected commuters were asked their willingness to use mobile based the ridesharing in future when it will become real practice in Sri Lanka. Accordingly, study found that more 80 percent of commuters in all commuters group willing to use the ridesharing if it is available for southern Expressway (83 % of the public bus users, 93 % personal vehicle users, 83 % of arranged hired vehicle) in spite of the novelty of the ridesharing concept in Sri Lanka. Moreover, it gives positive sign that understand the demand for the ridesharing.

Preference Towards the Ownership of the Ridesharing Application

There is a challenge of introducing the ridesharing concept into Sri Lanka as an alternative transportation option to reduce the traffic congestion based on its ownerships and authority. Few of similar transportation options were failed at the beginning due to weakness of planning and establishment [1]. In this context, commuters were asked their preference toward the initiation and establishing this the ridesharing concept in Sri Lankan. Fifty-seven (57%) percent of the public bus users prefer to government sector involvement in the ridesharing application mainly due to trustworthiness and accountability of the public sector over the private sector. The opposite of that idea who prefer the private sector, perceived the private sector as more efficient than the government. Accordingly, 60 percent of personal vehicle users prefer the private sector ownership of this project in future. Arranged vehicle commuters had equal preference for both sectors (50 %).

Perception Difference Among Three Commuters' Groups on the Ridesharing Concept

This study statically analyzed the any difference of perceptions of three commuter's groups towards the ridesharing concept if it is implement in future (Table 01). Kruskal Wallis H test used to analysis any different between three commuters' groups. According the Kruskal Wallis H test, there was no statistically significant differences towards perception of the ridesharing application among different commuters' groups and this

gives us exact guidelines to propose activities if we implement the ridesharing application in future in Sri Lanka.

Table 1: Kruskal Wallis test for find difference between three commuters’ groups

Variable	sample	Mean rank	Chi square value (df=2)	Significant p value	decision
Awareness	01	44.50	1.954	0.376	Not significant difference about awareness of the ridesharing among three groups
	02	49.00			
	03	43.00			
Purpose of using	01	43.63	1.552	0.460	Not significant difference about purpose of using the ridesharing among three groups
	02	43.05			
	03	49.82			
Available facilities	01	45.95	0.220	0.896	Not significant difference about available facilities to use the ridesharing among three groups
	02	45.95			
	03	44.60			
Willingness to use	01	47.00	1.712	0.425	Not significant difference about willingness to use the ridesharing among three groups
	02	42.00			
	03	49.50			
Sector preference	01	42.00	1.671	0.434	Not significant difference about ownership of the application among three groups.
	02	49.50			
	03	45.00			

Significant at 0.05 level (2-tailed)

Potential Barriers and Constraints to Apply the Ridesharing

Furthermore, study examined the potential barriers and constraints of application of internet based the ridesharing system in Southern Expressway, based on the main three variables identified through informal discussion with the general commuters in Sri Lanka. Sri Lankan has unique cultural and traditional believes and behavioral patterns which might act as barriers to implement the ridesharing concept in such as commuters’ idea on travel with strangers (strange fear), preference of travel with opposite gender and impact on social status.

Commuter's Preference on Sharing Trips with Strangers

One of the main characteristics of the ridesharing application is to travel with strangers. This has identified as one of the risk as well limiting factor for the ridesharing application in many contexts. There is a one common core problem of the ridesharing application in many contexts in the world due to risk associated with the traveling with unknown people. This has led to people reluctance to use the ridesharing. This study also revealed that the majority of the public bus users (57%) and 63% of arranged vehicle users reluctant to travel with strangers. However, slight the majority of the personal vehicle users (53%) are willing to travel with strangers (Figure 06).

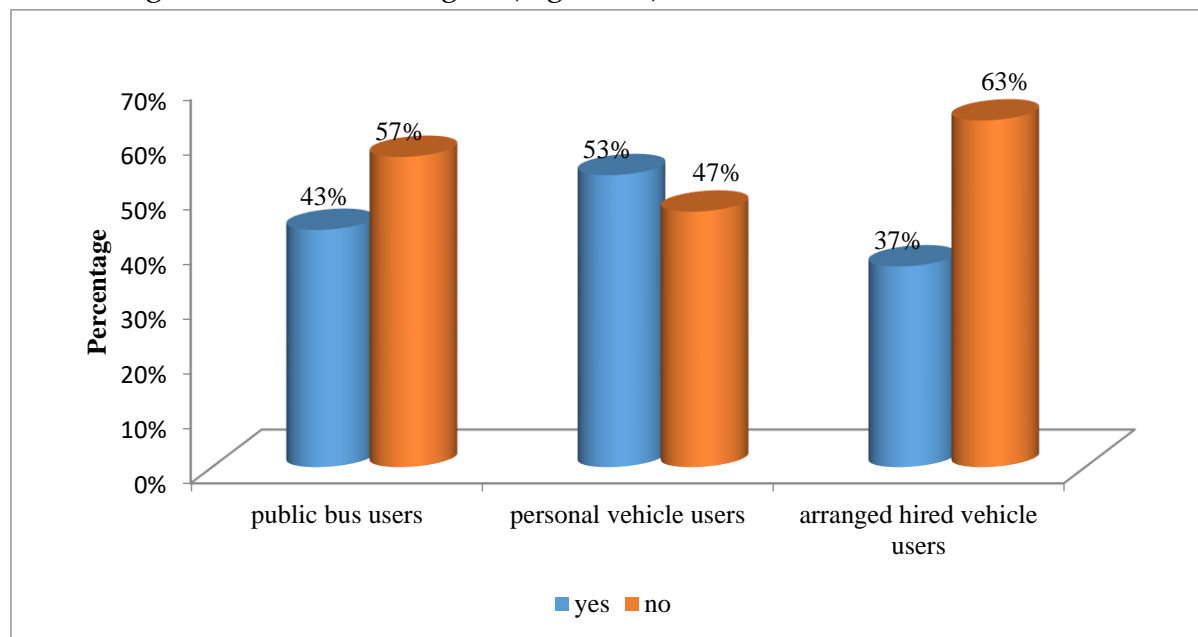


Figure 06: Preference on sharing trips with strangers

Furthermore, this study investigated the gender issues of the use of the ridesharing application in Sri Lanka due to cultural and religious influence of the Sri Lankan society. These cultural issues being a barrier to make relationships with unknown people. Specially the female does not like to travel with opposite gender. However, according to this study, the majority of the commuters in all three groups have not considered the gender as the relevant factor to travel. However, 30% of the public bus users, 17% of personal vehicle users and 23% of arranged hired vehicle users have reluctant to travel with the opposite gender. In this study, 43 % of the public bus users, 23 % of personal vehicle users and 67 % of arranged hired vehicle users were female commuters (Figure 07).

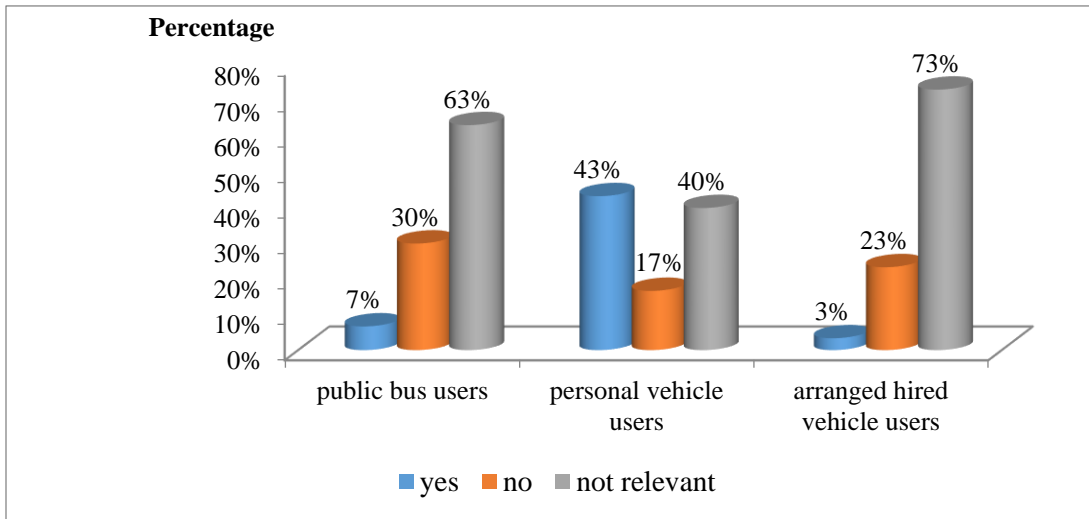


Figure 07: Preference on travel with opposite Gender

Moreover, many Sri Lankan are trying to main their status within the society based on the current profession, income level and educational background. Those peoples in the society are usually reluctant to share their transport facility with others. Therefore, respondent of this study were asked about their preference to use the ridesharing transport facility as their routinized travel options irrespective of their social status. Anyhow the majority of the personal vehicle users (47 %) and arranged vehicle users (53%) didn't care about their social status to select travel option (Figure 08). More accurately all commuters in three groups did not bother their social status to select the ridesharing as their travel option.

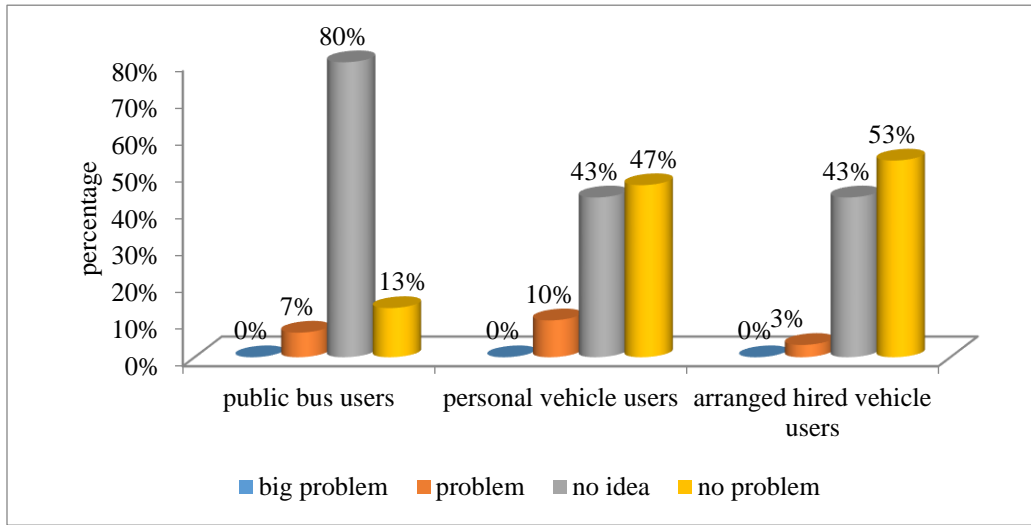


Figure 08: Impact on social status for willingness to use ridesharing

Furthermore, Kruskal Wallis test was done to test any perceptual difference between groups towards the potential constraints of the ridesharing option as the travel mode in southern expressway. Table 2 shows the test results.

Table 2: Kruskal Wallis test for find difference between three groups

Variable	Sample	Mean rank	(df=2)	p value	Decision
Commuter's preference on sharing trips with strangers	01	46.00	1.691	0.429	No any perceptual difference among three groups for traveling with strangers.
	02	41.50			
	03	49.00			
Commuter's preference on travelling with opposite gender	01	49.20	12.168	0.002	Observed Significant perceptual difference among three groups on traveling with opposite gender
	02	33.78			
	03	53.52			
Impact on social status	01	35.23	9.592	0.008	Observed Significant perceptual difference among three groups about social status when using the ridesharing travel option.
	02	48.30			
	03	52.97			

Significant at the 0.05 level (2-tailed)

Accordingly, Kruskal Wallis H test showed the significant difference on their perceptions towards the travelling with opposite gender and the impact on social back ground. This

shed some lights on future plans if we introduce the ridesharing as a travel options to Sri Lanka.

Conclusion

This research study was conducted to examine the potential to apply the ridesharing method into the Southern Expressway. The core objective of this study was to find the commuters' perception of the ridesharing method. This is very newly concept to most of the Sri Lankan. Even though it is a new concept, after knowing about that, the majority of the respondent's idea was this application was good and they like to have it if it is available. When ascertaining the problems of current transportation system available in Southern Expressway, commuters have several issues with the current transportation system available at Southern Expressway. The majority of the commuters (90%) use Southern Expressway to travel their work place. Those commuters have different ideas about travel cost in Southern Expressway. The majority of the public bus users (53%) idea is travel cost is very high in Southern Expressway. But according to the both personal and arranged hired vehicle users the travel cost is a fair cost. The availability of buses also not in a satisfactory level. Most of the commuters work at night and they have no buses to travel at that time in Southern Expressway. Commuters frequently faced such problems and they have to spend lot of money to travel at off times. When analysis the commuters' perception towards the internet based the ridesharing concept in Southern Expressway, there is no significant difference among these three groups statistically towards the perception on the ridesharing. Commuters' preference on the ridesharing is considerably high. More than 90% of commuters willing to use it. Most of the commuters (90%) want to use this application to save their money and time. Only few want (6%) to conserve the environment. More than 90% of the commuters have the access to the internet. There is not much difference on their ideas about the ridesharing concept and willingness to have it, therefore it shows that there is a good potential for applying the ridesharing into the Southern Expressway. Commuters more prefer the private sector introducing such application rather than government sector. When examine the potential barriers and constraints of application of internet based the ridesharing system in Southern Expressway, there are certain barriers to apply the ridesharing. Still this application is not in the usage. So people have no idea how it will affect to their day to day life. Specially the impact of social status and gender issues may be a problem while using it in the future. When having with the informal discussion with commuters, they mentioned that, they have concerned about the security more than the benefits of this method. But consider all

the barriers as overall, it will not significantly affect to the application of the ridesharing in Southern Expressway as another option to travel. The consistency of this application highly depends on the commuters' positive attitudes towards this concept. After conducted this study, there have some recommendations for the future of the ridesharing application in Sri Lanka. The first thing is promotion of this application among the commuters. If the advertising is good, it will help to establish mobile based the ridesharing application in Sri Lanka with fewer difficulties.

Also government can intervene to convince the people to use the ridesharing by giving some benefits for the users of this application such as no parking costs, no tolls etc. Available network transport companies in Sri Lanka can involve introducing mobile based the ridesharing to their customers as well. In Sri Lanka, at the present, available several leading transport network companies who are providing real time rides to their customers using GPS technology. Therefore, it will be easy to apply the ridesharing through available network transport system. Owners of the application can offer some benefits such as free rides to the commuters who used the app frequently and it will help to promote this concept among the commuters in Southern Expressway.

Conflicts of Interest

The authors declare no conflict of interest.

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