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Exploring the determinants of public transport system planning in car-dependent cities

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Abstract

This paper attempts to explore the determinants of public transport system planning based on people opinions in car-dependant cities. A survey has been conducted to collect the data for determining the people opinion of the following public transport characteristics: walking distance, mode preference, number of transfers and comfort. A questionnaire was distributed to collect this information for different age groups of Jeddah city residents. Jeddah city, the second largest city is Saudi Arabia, characterized by high car dependency and currently faces the challenges of planning effective and sustainable public transport system.

Keywords: Public transport system; planning, car-dependent; people opinions; Jeddah

1. Introduction

A number of urban practitioners claim that there is certainly a robust association amid the standard of living and demand for cars and more private spaces; increasing household income inspires people to purchase a car and relocate in low density suburbs, causing huge alterations on a city's transportation and land use (Gomez-Ibanez, 1991; Schafer and Victor, 1997). Researchers attempted to reject the universality of the above argument as the Australian

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and North American cities have followed the aforementioned pattern while the other cities (mainly in global north) became more compact after growth in incomes (Frost, 1991). Experts on urban transport tried to dismiss series of myths of higher automobile dependence such as wealth, space, climate, health, age, social problems, rural life styles, the road lobby, traffic engineering, land developers and town planning (Newman and Kenworthy, 2000) and stressed to transform the town planning practices to achieve goals of sustainability. However, exceptions also go simultaneously as American cities are still too scared to make driving unattractive.

Cities in gulf have shown similar tendencies that in Australia and North America. Dependency on car based travel in Saudi cities has augmented in last couple of decades due to continued economic growth; creating adverse impacts for ambient air quality (Khodeir et al., 2012; WHO, 2014a), emissions (Hoornweg and Freire, 2013), walkability and bicycling; these cities predominantly consider uses of cars as an easy and obvious mode of urban transit. Though prices of cars and fuel are cheaper in these cities; the undesired consequences of higher private car ownership including traffic congestion and compromised urban health (UN-Habitat, 2012; WHO, 2014b) calls to plan for a sustainable public transportation system in the urban areas.

Shifting from car to public transport is quite a challenging task for urban transport planners and policymakers. The private automobiles (especially cars) are usually treated as most convenient travel option; hence experts emphasises on the need to augment acceptability of public transport systems blended with higher reliability, efficiency, security and safety (UN-Habitat, 2013).

Urban transport planners are struggling to ameliorate the quality of public to match overgrowing desires and aspirations of commuters worldwide (Ji and Gao, 2010; Currie and Delbosc, 2011). For each and every single trip users have the choices of distinctive nature with their own typical pros. and cons. (Garling, 2005).Since user's endeavors is of paramount significance in the success of a public transport system people's choice of travel behaviour should be well investigated. In general a person prefers a service over all the reasonable alternatives if it offers maximum efficiency. These preferences are the results of a persons' sense of satisfaction and ability to make wise decisions comprising utility maximisation under constrained budget (Jillan, 2005).

Nevertheless, many previous studies have examined the determining factors in the planning of sustainable public transport in urban areas; there is a lack of studies to explore people's preferences and priorities in a typical Saudi city which contain unique socioeconomic, religious and cultural characteristics. Accordingly, this paper attempts to explore the determinants of public transport system planning based on people opinions in Jeddah city, a car-dependant city in Saudi Arabia.

2. Methodology

2.1. Study area

Jeddah city is second largest city and the first commercial city in Saudi Arabia. Jeddah located on the western region on the Red Coast, figure 1.

The travel pattern in Jeddah city has changed dramatically over the last four decades due to rapid urban growth. Jeddah’s transport mode share has noticeably altered and the share of the non-private vehicle modes daily trips has declined to about 7% in the year 2007 from about 50% in the year 1970, while the share of daily trips by car increased to about 93% in the year 2007, from about 50% in 1970 (MOMRA, 1980; Municipality of Jeddah, 2006; IBI, 2007).

The total number of the daily trips has increased from about 293,370 trips in the year 1970 to about 6,051,883 trips in the year 2007 (MOMRA, 1980; IBI, 2007). This has place a huge pressure on the Jeddah’s existing transportation infrastructure (Aljoufie et al., 2013).

Two main systems represent public transport in Jeddah: (1) The Saudi Arabian Public Transport Company (SAPTCO), which operates the regulated bus systems; (2) Unregulated Coaster buses services operated by individuals (Aljoufie, 2014). The SAPTCO regulated bus system consists of approximately 90 buses. It is operated on eight main service lines that cover in total a distance of 150 km, figure 2 (Aljoufie, 2014). The unregulated coaster buses are operated in 10 main service lines that cover in total a distance of 160 km, figure 3 (Aljoufie, 2014). This service includes 1737 old coaster buses (19 to 21 passenger capacity), 1972-1982 models, and only 5%
are valid to operate (Althagfy, 2003). Low accessibility, bad buses conditions, unscheduled services, deficient infrastructure are common problems of the current public transport in Jeddah (Aljoufie, 2014).

Fig. 1. a) Geographic location of Jeddah in Saudi Arabia; b) Jeddah city

Fig. 2. SAPTCO service lines (Aljoufie, 2014)

Fig. 3. Unregulated coaster buses service lines (Aljoufie, 2014)
As a result, Jeddah currently witness a haphazard transport issues. To address these issues, a public transport system has been promoted by Jeddah municipality. Nevertheless, the determinants of public transport system planning based on people opinions in Jeddah city received a little attention. The study area of this study covers the large extent of the urban area in Jeddah city to explore the determinants of public transport system planning based on Jeddah people opinions.

2.2. Questionnaire

Questionnaire was designed to explore the determinants of public transport system planning based on Jeddah people opinions. It consisted of two main parts. First part includes individual’s socio-economic characteristics, such as age, gender, education level, and income level.

Second part includes the individual’s opinions of the public transport system planning determinants in Jeddah. A review of literature prompts that performance of public transport services has been measured in form of commuter's satisfaction to answer in what manner a particular public transport service meet or surpasses their anticipations (Currie and Wallis, 2008; Geetika and Nandan, 2010). Quality of public transport services could be quantified in either ways such as commuter's anticipations, satisfaction, attitudes expressed in form of walking distances to get a public transport node, preferences for modes, number of transfers, time consumed in trips, accessibility of service, comfort inside and outside and associated set-ups (Litman, 2008). Researchers have tested association between service quality and customer satisfaction, destination satisfaction, commuter's behavioural intentions and involvement, variability between operators, factors affecting commuter's loyalty, correlation between structural problems and a high level of perceived quality and operational level of services & effectiveness of related priorities on strategies (Thompson and Schofield, 2007; Yannis and Constantinou, 2008; Barabino et.al., 2011; Li and Chen, 2011; Yang et.al., 2012; Islam et.al., 2014; Aitor et.al., 2015). Moreover the importance of hybrid delivery of public transport has also been investigated (Douglas and Warner, 2014) that is thought to be future of public transport.

In view of that, four public transport characteristics were selected to explore the individual’s opinions of the public transport system planning determinants in Jeddah; namely: walking distance, mode preference, number of transfers and comfort. Respondents were asked to determine their personal opinions of the characteristics:

- Maximum walking distance (time) to the nearest public transport station.
- Preferred mode of transport.
- Number of transfers.
- Comfort of using public transport with family.

Each of these characteristics was divided into several closed-ended multiple-choice questions.

The questionnaire was designed to take 5-10 minutes to complete in order to increase the rate of respondent. The survey was conducted between January 10th and February 10th 2015. Respondents were invited to participate at main activity centres, such as shopping centers, universities, major intersections and main streets. The questionnaire was also distributed online in social networking sites such as Whatsapp and Twitter.

3. Results

A total of 1300 questionnaires were distributed. Out of the total respondents, 333 questionnaires were partially filled out while 967 questionnaires were fully completed. The fully completed questionnaires were considered in the analysis.

3.1. socio-economic characteristics

Table 1 depicts the respondents’ socio-economic characteristics. A varied socio-economic characteristics of the respondents is noticed in the considered sample of questionnaires.
The majority of respondents (43.2 %) are between 20 and 30 years as depicted in Table1, while about 23.4% of the respondents are between 31 and 40 years. Respondents between 41 and 50 years are about 19.9% whereas about 7.5.8 % accounted for respondents between 51 and 60 years; and about 6% of the respondents aged 61 years and above.

<table>
<thead>
<tr>
<th>Socio-economic attributes</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-30 Years</td>
<td>418</td>
<td>43.2</td>
</tr>
<tr>
<td>31-40 Years</td>
<td>226</td>
<td>23.4</td>
</tr>
<tr>
<td>41-50 Years</td>
<td>192</td>
<td>19.9</td>
</tr>
<tr>
<td>51-60 Years</td>
<td>73</td>
<td>7.5</td>
</tr>
<tr>
<td>61 Years and above</td>
<td>58</td>
<td>6.0</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>623</td>
<td>64.4</td>
</tr>
<tr>
<td>Female</td>
<td>344</td>
<td>35.6</td>
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<tr>
<td>Nationality</td>
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<tr>
<td>Saudi</td>
<td>783</td>
<td>81.0</td>
</tr>
<tr>
<td>Non-Saudi</td>
<td>184</td>
<td>19.0</td>
</tr>
<tr>
<td>Education level</td>
<td></td>
<td></td>
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<tr>
<td>Primary</td>
<td>64</td>
<td>6.6</td>
</tr>
<tr>
<td>Secondary</td>
<td>237</td>
<td>24.5</td>
</tr>
<tr>
<td>Diploma</td>
<td>93</td>
<td>9.6</td>
</tr>
<tr>
<td>Bachelor</td>
<td>453</td>
<td>46.8</td>
</tr>
<tr>
<td>Master</td>
<td>97</td>
<td>10.0</td>
</tr>
<tr>
<td>Doctorate</td>
<td>23</td>
<td>2.4</td>
</tr>
<tr>
<td>Monthly income level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 5000 SAR</td>
<td>274</td>
<td>28.3</td>
</tr>
<tr>
<td>5000 -10000 SAR</td>
<td>243</td>
<td>25.1</td>
</tr>
<tr>
<td>10001 -15000 SAR</td>
<td>262</td>
<td>27.1</td>
</tr>
<tr>
<td>More than 15000 SAR</td>
<td>188</td>
<td>19.4</td>
</tr>
</tbody>
</table>

Table 1 also shows that the majority of the respondents (64.4%) are male and 35.6 are female. On the contrary, results reveal that the sample is dominated by Saudi nationality wherein 81% of the respondents are Saudi, while 19% are none-Saudi as depicted in Table 1.

Education level information shows a diversity of education level of the respondents as depicted in Table 1. The majority (46.8 %) of respondents are with bachelor education level, while about 24.5 % of the respondents are
educated up to secondary level. Results also show that 9.6% and 10% with diploma and masters education level respectively. About 4.48% of the respondents are educated up to the doctorate level, while about 6.6% of the respondents have a low education level up to the primary level.

Finally, the results indicate a varied monthly income level of the respondents as shown in Table 1. About 28.3% of the respondents earn less than 5000 SAR monthly, while about 25.1 of the respondents earn between 5000 and 10000 SAR monthly. About 27.1 of the respondents earn monthly income between 10001 and 15000 SAR, whereas about 19.4 of the respondents earns more than 15000 SAR monthly.

3.2. Determinants of public transport system planning

3.2.1 Maximum walking distance

Respondents were asked to indicate the maximum walking distance to the nearest public transport station. Respondents were given four walking distance in time: less than 5 minutes, 5-10 minutes, 10-15 minutes and more than 15 minutes. Figure 4 depicts the results of respondent’s opinions about the maximum walking distance.

![Graph showing the maximum walking distance preferences](image)

Fig. 4. Respondent’s opinions about the maximum walking distance

Although large proportion of the respondents (34.7%) prefer a short walking distance (less than 5 minutes), the majority of the respondent (39.6%) are willing to walk 5-10 minutes to nearest public transport station. About 15.6% of the respondents are willing to walk 10-15 minutes to the nearest public transport station, while small proportion of respondents (10%) are willing to walk more than 15 minutes.

3.2.2 Preferred mode of transport

Respondents were asked to indicate the preferred mode of transport in the future. Respondents were given six modes of transport namely: car, taxi, bus metro, bicycle and walking. Figure 5 depicts the results of respondent’s preference of the future transport mode in Jeddah.
Results indicate that a large proportion of respondents prefer public transport as compared to car. The majority of the respondents (43.1%) prefer the metro for future transportation. About 11.2% of the respondents prefer the bus for future transportation, 4.2% prefer bicycle and 5.8% prefer walking respectively. It is noted that a considerable proportion of the respondents would still prefer car for future transportation which necessitate an efficient plan of public transport in Jeddah city that meet the willingness and preference of Jeddah residents.

3.2.3 Number of transfers

In this part, respondents were asked to indicate the how many transfers they prefer when using public transport. Respondents were given three choices: one transfer, two transfers, three or more. Figure 6 shows the results of respondent’s preference of the number of transfers.

The majority of the respondents (71%) prefer one transfer when using public transport. About 22.1% of the respondents prefer two transfers, while only 6.8% of the respondents prefer three or more transfers. Accordingly, one transfer must dominate the planning of the future public transport system in Jeddah.

3.2.4 Comfort of using public transport with family

Saudi cities contain unique socioeconomic, religious and cultural characteristics. In accordance to that, respondents were asked to indicate their comfort of using public transport with family. Respondents were given three choices: yes, no and yes with additional requirements. Figure 7 depicts the results of respondent’s opinions about comfort of using public transport with family.

It is noteworthy that a large proportion of the respondents (40.5%) are willing to use public transport with family. It is noted also that a considerable proportion of the respondents (28.7%) of the respondents are not willing to use public transport with family, while about 30.7% are willing to use public transport with family, but with additional requirements. Most of these requirements imply privacy issues and family facilities. Therefore, future planning of the public transport system in Jeddah must pay a considerable attention to these requirements in order to increase the ridership and compete with dominant car reliance.
Fig. 6. Respondent’s preference of the number of transfers

Fig. 7. Respondent’s opinions about comfort of using public transport with family

4. Discussion and conclusion

Urban transport planners at present are conceptualizing a series of innovative tools and methods to enhance sustainability in the public transport systems such as automated people mover-APM, high resolution spatiotemporal
modeling, evaluating non-motorized access and non-work trip usage, subsidy models (Hao et al., 2009; Tribby and Zandbergen, 2012; Paget-Seekins, 2012; Maskey et al., 2013) Nonetheless any tool, method and technique adopted to plan for Sustainable Public Transportation depends upon certain determinants perceived by its users discussed further.

This paper has strived to explore the determinants of public transport system planning in Jeddah city, a car-dependant city in Saudi Arabia. Results indicate that, most of the respondents are willing to walk a short distance to the nearest public transport station. Although a large proportion of the respondents prefer the public transport for future transportation, still a notable percentage would prefer car. Results also point out that one transfer must dominate the planning of the future public transport system in Jeddah. Moreover, results reveal it is important that the future planning of the public transport system in Jeddah pay a considerable attention to the family privacy and requirements in order to increase the ridership and compete with dominant car reliance. Finally, further studies to explore other public transport determinants in Jeddah city are recommended.

References


