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MOBILITY IN THE DEVELOPING COUNTRY. THE CASE STUDY OF BANGKOK METROPOLITAN REGION

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Resume

Significant economic growth visible in recent decades in Thailand contributed to a huge demand for private vehicles, which was not followed by a sufficient growth of transport infrastructure, consequently leading to permanent congestion, increase in the number of accidents, high carbon emission and thus a decline in the air quality. This research was conducted in the capital of Thailand, Bangkok using key informant interviews to examine socio-economic determinants of 3 different modes choice: car, motorcycle and public transport. The major findings included the lack of use of public transportation due inadequate transportation schemes and policies at the local and national level in Thailand. Further analytical findings include the social, cultural and economic factors affecting the choices of the mode of transportation in Thailand.

Article info

Received 7 July 2021

Accepted 7 March 2022

Online 9 May 2022

Keywords:

travel mode choice
travel behaviour
Bangkok
Thailand

Available online: <https://doi.org/10.26552/com.C.2022.3.A112-A122>

ISSN 1335-4205 (print version)

ISSN 2585-7878 (online version)

1 Travel behavior

1.1 Mobility trends

Promoting the low carbon transport and reducing the need for private vehicle travel can be a major solution for the increasing problems caused by transit, such as environmental pollution, public health issues, road safety and rising costs of building and modernizing transport infrastructure. Research from several western countries present shifts in the mobility trends between generations in favour of public transit and other more sustainable transport modes [1-4]. This phenomenon is also known as a “peak car” theory and represents a decline in the car ownership, driver’s licence ownership and kilometres travelled [5]. Explanations for that phenomenon vary by different studies, conducted in different countries. Some studies have ascribed the reversal in car dependence to changes in the economy as financial crises and rising fuel prices [6]. Another present social changes such as lower incomes, global preference for less car-dependent inner-city living, increasingly restrictive driving license regimes and delay in the life stage of millennials, in areas such as full-time work,

home ownership, marriage and child-rearing, which do not induce them to own a private car in comparison to the previous generations [7]. It is also argued that changes are caused by attitudes and preferences change triggered by increased use of information communication technology (ICT) and its’ services such as e-commerce, social networks and mobility as a service (MaaS) [8]. Trends towards decreased car dependence can be also explained by shifts in the increased multimodality [9-10]. On the other hand, environmental awareness about the impact of transit on the environment has proven to be the minor reason for the licencing decline and travel mode change [7, 11].

Regardless of the noticeable changes in the developed countries, constant preference for private transit, mainly based on cars and motorcycles, has been still strongly visible in the Southeast Asian economies; in some of those countries, motorization rates exceed both the population growth and urbanization rate [12]. For the main cause of unsustainable transport practices in Bangkok Metropolitan Region is monocentric urban development, high income gap between social classes causing uneven spatial distribution of housing and employment and thus different commuting possibilities

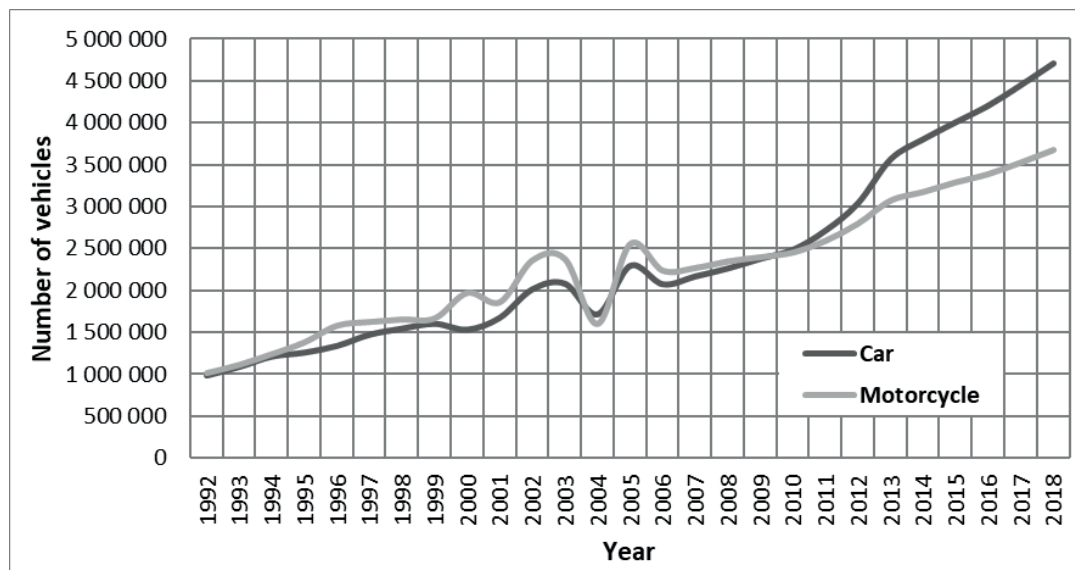


Figure 1 Accumulated number of private vehicles registered in Bangkok Metropolitan Region between 1992 and 2018

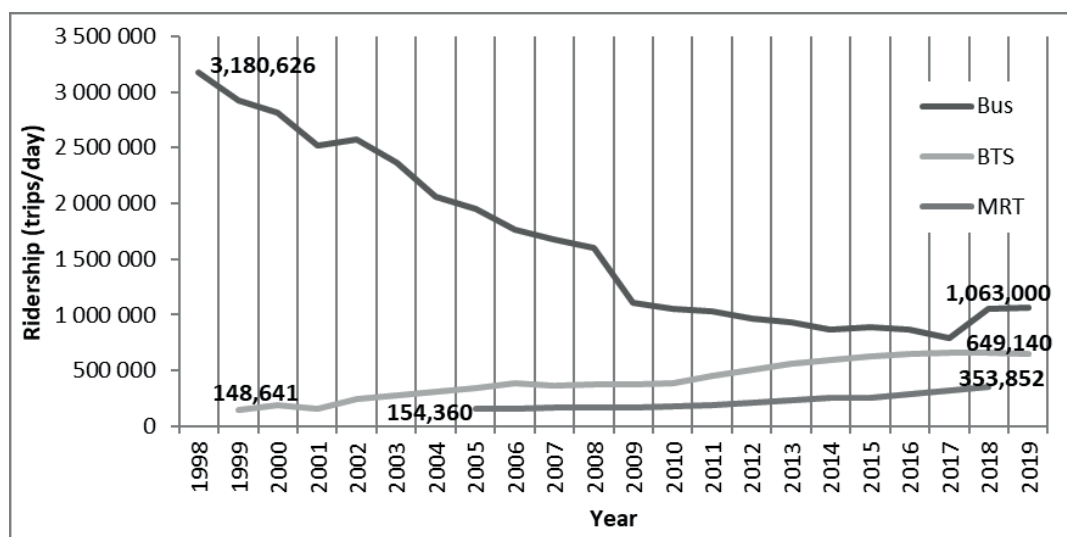


Figure 2 Share of public transport journeys in Bangkok Metropolitan Region between 1998 and 2019

for different social groups [13]. Furthermore, research presents unfavourable opinions of the elderly, disabled and indigent travellers regarding the accessibility, safety, connectivity and affordability of the metro system in Bangkok Metropolitan Region [14].

On the other hand, studies emphasise the importance of cultural differences between developing and developed economies and hence different factors important for travellers in the travel mode choice. Diversity in culture and social life among Asian countries reflect how people think about private transportation versus public transit [15]. In some of the developing countries private vehicle is considered as much more attractive mode of transport, providing more status and pleasure than other modes [15]. In order to prevent from further superiority of private vehicles in many Asian countries, “push and pull” strategies have been implemented using price mechanisms and usage management strategies to reduce

the demand for motorized vehicles, as well as the quality improvement strategies of the public transport service, to attract more passengers and to reduce the market share of motorized vehicles [16]. Nevertheless, mobility management strategies focused on communication and persuasion, providing detailed travel information and incentives through marketing techniques in order to reduce the car use and increase use of public transit among specific socio-economic groups, have not been widely considered [17].

1.2 Transport environment in Bangkok Metropolitan Region

Thailand is a developing, upper-middle income country [18]. In 2019 the population of Thailand was more than 66.59 million people [19], with 39,160,454 vehicles

Table 1 *Thematic layers for content analysis*

Serial number	Factors	References	Sub theme
1.	Gender	[23] [24] [25]	Demographic
2.	Age	[26] [27] [25]	
3.	Education	[27]	Personal
4.	Occupation	[28]	
5.	Commuting mode	[29] [15]	
6.	Income	[25]	Economic
7.	Number of owned cars	[30]	
9.	Number of owned motorcycles	[16]	
10.	Travel time	[31] [32]	External
11.	Travel cost	[33] [32]	

registered and an increase of 2.05 % or approximately 0.97 million vehicles per year between 2015-2019 [20]. Private motorcycles accounted for 53.96 % (21,130,663), whereas private passenger cars for 42.43 % (16,616,848) of the total number of vehicles on the roads of Thailand. Furthermore, in 2019 total number of driving licences was 31,575,798 and growing by 2.32 % or about 0.87 million licenses per year between 2014-2018.

The capital of Thailand, Bangkok, with the surrounding provinces, known as Bangkok Metropolitan Region, is inhabited by more than 10.890 million people [19]. Data compilation and analysis concerning trips made in Bangkok and its vicinities [21]. showed that private-vehicle trips, both by cars and motorcycles have grown steadily (Figure 1). Registered cars surged from 987,999 in 1992 to 4,714,916 in 2018, an average increase of 6.58 % per year. In the same period, number of registered motorcycles has risen from 1,006,302 in 1992 to 3,669,600 in 2018, an average increase of 6.10 % per year.

Bangkok is the only city in Thailand equipped with the developed public transport systems that has continually been invested by the government in order to address the traffic problems. The city is served by many public and private transport providers from which the most important are bus-lanes (Bangkok Mass Transit Authority), BTS Sky Trains (Bangkok Mass Transit System) and MRT (Metropolitan Rapid Transit) accounting for 91.47 % of passenger ridership in 2018 [21]. Public bus transportation recorded substantial ridership decrease from 4,073,883 trip/day in 1992 to 1,063,000 trip/day in 2019 (exclusive of free user), BTS Sky Train between 2019-2020 carried 649,140 passengers per day with an upward trend since the beginning of the system's operation, while MRT in 2018 carried 337,000

passengers daily, also presenting a growing tendency (Figure 2). Presently, the city authorities urge the Bangkok Metropolitan Region network's expansion and emphasize the connection of different transport modes.

From the above-mentioned data, it is concluded that travel by private vehicle is likely to grow based on the increase in the number of vehicles registered, while travel by public transportation as a whole will continue to fall, thereby intensifying traffic problems within the Bangkok Metropolitan Region. Although travel by BTS and MRT has grown steadily, such ridership growth is still behind the expected number. According to the government forecasts, in 2029 57.6 % of trips in the Bangkok Metropolitan Region are expected to be made by private vehicles, including private cars 41.1 % and motorcycles 12.4 %, whereas the public transport use will compose of 42.4 % [21].

1.3 Theoretical framework

Travel mode choice studies are often based on the utility maximization theory assuming that the travel mode choice is made rationally and travellers choose the mode with the highest utility among the alternatives, as determined by their socio-economic characteristics (income, employment status, gender, number of children etc.) and the service attributes of modes (travel time, travel cost, availability etc.) [16, 22].

The conceptual framework for this study has been derived through previous literature, responses from the respondents and findings among new studies in the transportation research (see Table 1).

Gender: In the traditional societies and developing economies women tend to both make less trips and

use passenger car less frequently than men do. Study conducted among indigent people living in Bangkok, found that male commuters are more dependent on private motorcycles and less on public transport than female commuters.

Age: Research from western countries confirm the existence of differences between generations in terms of travel behavior, caused by wide variety of factors. In Bangkok, dependence on private transportation modes increases and dependence on public transport decreases with age.

Education: Current millennials have the highest level of participation in higher education of any generation in the USA. Higher levels of education through the bachelor's degree level are associated with higher levels of daily vehicle kilometers travelled per capita along. Additionally, workforce participation is associated with significantly higher per capita daily vehicle kilometres travelled.

Occupation: The changes in residence and employment contribute to a great extent to changes in the commuting patterns, with private mode of transport becoming more frequently used, while use of other modes decline.

Commuting mode choice: Social-role and self-identities are important predictors of mode choice and may prevent travel behaviour change. According to [15] attitude toward car and public transit provide valuable insights regarding the commuting mode choice in Asian countries. In Thailand, the intention and desire to use the car for commuting is found to be high.

Income: Travel behavior of indigent people living in Bangkok depends not only on income but also on public transport availability, job location and place of residence. Suburban residents with limited public transport accessibility tend to use private transportation modes, mainly motorcycles, regarding their greater affordability and spend a large portion of household expenditures on vehicle and fuel. Study emphasizes importance of low-cost public transport to vulnerable subgroups of the urban poor.

Number of owned car: The habitual behavior of private vehicle use hinders an individual's intention to switch from a car or motorcycle to public transit. Furthermore, motorcycle commuters are more likely than car commuters to switch to a public transit through their reasoned evaluation process.

Number of owned motorcycles: It is found that in the motorcycle dependent region travellers with higher motorcycle ownership rates or lower incomes are more likely to use motorcycles. In the motorcycle-dependent area without a good public transportation system, motorcyclists might be more likely to switch to a car, rather than to public transport.

Travel cost and time: Thai travellers' mode choice behavior on mass transit is significantly affected by the total travel cost in private transport, total travel time in public transport and distance range from home to

mass transit station. Moreover, studies emphasize the importance of social equity in long-term urban transport plans regarding access to jobs reachable by marginalized groups within a defined travel time threshold and a fare policy eliminating social exclusion from particular public transport modes because of travellers' financial status by the implementation of a fair fare system. In regard to the value of travel time to work, it is higher in high-income groups. As income increases value of travel time also increases. Furthermore, as trip length increases, the value of travel time increases.

2 Materials and methods

2.1 Procedure

In order to acquire travel behavior information, the interview checklist was divided into 2 parts. Part 1 consists of the respondent's socio-demographic information such as gender, age, education, occupational status, income, number of owned cars and motorcycles. Part 2 presents the information about the travel mode choice and details of travel cost and time.

2.2 Data collection

To gather data from the respondents' key informant interviews were used. The interviewees were chosen through random purposive sampling among the general population, with one restriction, respondents had to be more than 18 years old as this is the minimum required age to drive a motor vehicle in Thailand, thus entitling to use all the studied transportation modes. The process of reaching out to the respondents was carried out over a period of 2 months. A total of 42 inclusive of 35 Thai nationals and 7 foreign residents were interviewed for this research. The sample size is adequate in terms of the randomly selected daily commuters to examine the travel behavioural choices, risk perceptions and factors involved through the detailed data collected among the respondents [34-36].

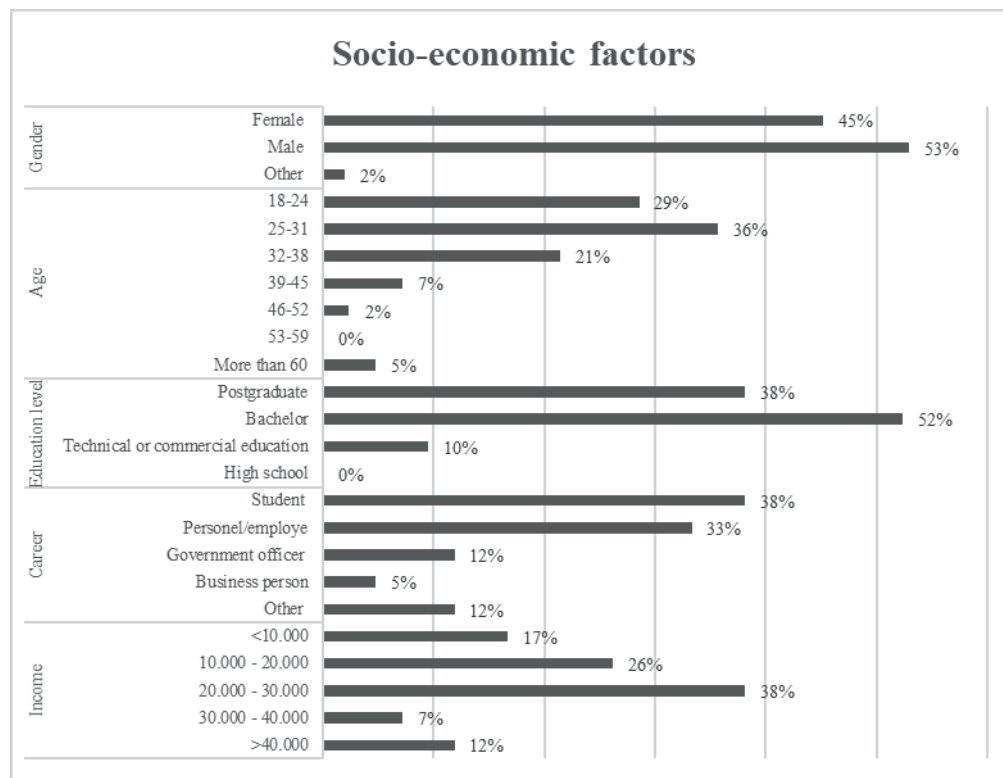
2.3 Profile of the respondents

The respondents for this research belonged to several varied levels of each factor. The respondents involved the overall perception and behaviour of the commuters. The factors are supported by the literature review and 42 key informant interviews. These key informant interviewees were selected based upon their inclusivity with major sectors of the Thai economy and societal set up (see Table 2).

The demographic and socio-economic factors are presented together in order to provide the scenario of the systems among commuters where these factors result in

Table 2 Sector-wise respondents

Number	Career/ Professional	Sector	Gender	
			M	F
1	Student	Education	5	3
2	Employee	Administration	4	2
3	Government official	Policy makers	5	3
4	Entrepreneur	Business	5	4
5	Elderly	Retired	3	3
6	Other	Social	3	2

**Figure 3** Prolife of the Respondents

the choices between the mode of transportation. These factors included gender, age, education levels, career and income levels of the respondents. The following chart provides for the detailed description of the profile of the respondents (Figure 3).

The gender in Thailand is divided into male, female and the third gender. The respondents belonged to all three types of gender. The male respondent was 53 %, female respondents were 45 % and others were 2 %. The factor of age was rearranged into range of years of age, in order to understand and analyse the different behaviours among different age groups. The respondents among the age group or 25 years of age to 31 years of age were highest with 36 %, followed by age group of 18 years of age to 24 years of age with 29 %, age group of 32 years of age to 45 years of age with 7 %, age group of more than 60 years of age with 5 %, age group of 46 years of age to 52 years of age with 2 %, however, there

were no respondent between age group of 53 years of age to 59 years of age.

In terms of the education level, it was found that all the respondents were over the education level of high school. It was found that higher education is pertinent among all age groups of respondents. The education level was found to be highest with the bachelors at 52 % followed by post-graduates with 38 % and technical or commercial education with 10 %.

The economic profile of the respondents was found among their distinctive careers and income levels. The career factor was depicted in terms of professional employment of the respondents. It was found that students were 38 % of the total respondents, followed by employees with 33 % respondents, government officers were 12 % followed by business entrepreneurs at 5 %, other employment careers were found to be 12 % of the total respondents. Similarly, the income levels among

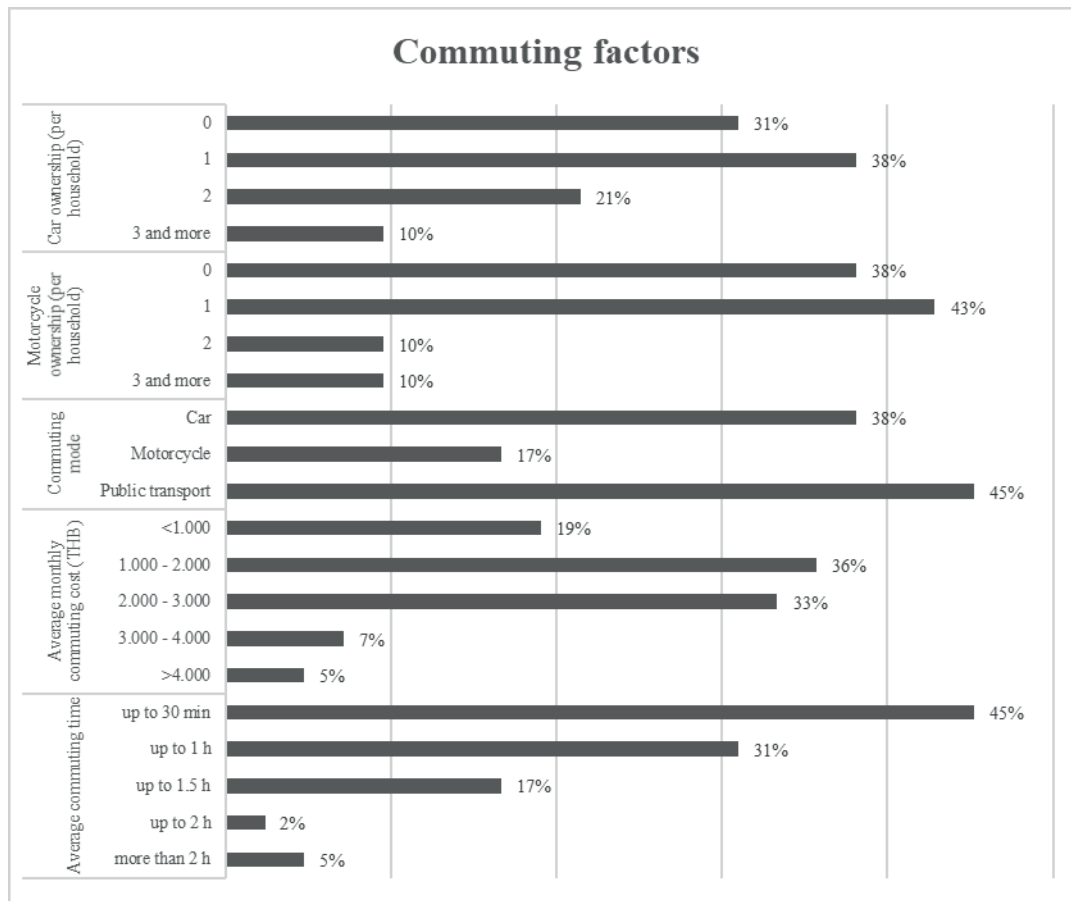


Figure 4 Survey results among commuting factors

the respondents were found to varied. The highest number of respondents were found in the range of 20,000 to 30,000 Thai baht (\$579.22-\$868.84) earnings per month with 38 % respondents. The other composition of respondent in their respective income range involved in the range of 10,000 to 20,000 Thai baht (\$289.61-\$579.22) earnings per month with 26 % respondents, less than 10,000 Thai baht (\$289.61) earnings per month with 17 % respondents, more than 40,000 Thai baht (\$1158.45) earnings per month with 12 % respondents and in the range of 30,000 to 40,000 Thai baht (\$868.84-\$1158.45) earnings per month with 7 % respondents.

The survey results pertaining to the commuting factors depicted that each factor contributes towards the behavioural approach and decision-making process to choose the mode of transportation. The data presents the gap among the financial status of the respondents, which in turn provided for the overall perception, understanding and choices of the daily commuters (see Figure 3).

In terms of car ownership, it was found that there are 31 % of the respondents who do not own car. The remaining 69 % of the respondents were found to own one (38 %), two (21 %) and 3 (10 %) or more cars.

It was found that respondents who do not own a motorcycle were 38 % of the total respondents. One

of the major reasons for not utilizing the motorcycle was the fact that respondents do not find it a secure mode of transportation [37]. The respondents owning one motorcycle were found to be 42 % of the total respondents, followed by respondents who owned two motorcycles with 10% and respondents with 3 or more than 3 motorcycles were 10 % of the total respondents.

The commuting mode choice depicted the findings towards the usage of public transportation as the first choice with 45 % of the total respondents. The second choice of daily commuting was found to be a car with 38 % and motorcycle with 17 % as the third choice of commuting (Figure 4). This was in line of the fact that Thailand has a sound network and infrastructure towards the public transportation. This effectiveness provides for the timely and ease of travel in the public transportation. However, public transportation such as sky train system are expensive but faster. In comparison, the public bus service is cheaper mode of transportation, however, it is more time consuming and uncomfortable, depending upon the air conditioning and/or seat quality [38].

The average monthly commuting costs in Thai Baht were divided into five ranges. The findings depicted that highest range of transportation expenses was 1,000 to 2,000 THB (\$28.96-\$57.92) with a total of 36 % respondents. The remaining range were inclusive of

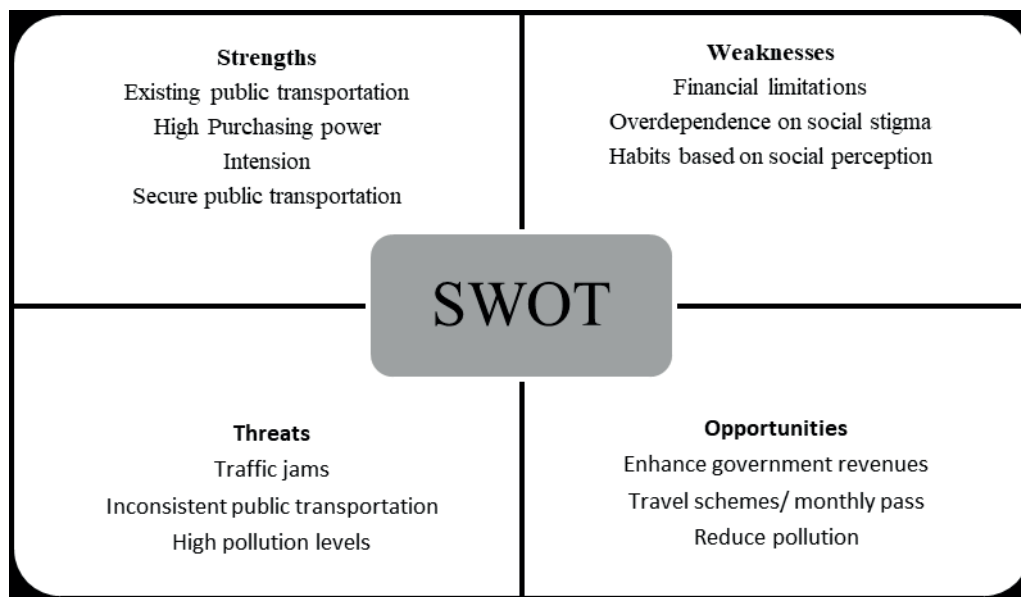


Figure 5 SWOT analysis for selecting mode of the transportation in Thailand

less than 1,000 THB (19 %), 2,000- 3,000 THB (\$57.92-\$86.88) (33 %), 3,000 to 4,000 THB (\$86.88-\$115.84) (7 %) and more than 4,000 THB (\$115.84) (5 %). The findings depicted that costs of commuting are the major factor, which affects the behavioural approach towards choosing the mode of transportation [32].

The travel time is also an important factor affecting the commuter's choice as discussed and presented in the literature review. The average commuting time was divided into five range of time slots to understand the value of travel time among daily commuters. The findings depicted that the respondents do not prefer to travel for longer time periods, for instance that travel time with less than 30 minutes was preferred by 45 % of respondents. Similarly, travel time between 30 minutes to 1 hour was preferred by 31 % respondents, followed by respondents who preferred travel time between 1 hour to 1.5 hours with 17 %, remaining 7 % respondents preferred between 1.5 hours to 2 hours and more than 2 hours with 2 % and 5 %, respectively.

The important factors were found to be travel time and travel costs [39]. The significant relationship was found between the economic capacities of the travellers and their income level. The findings depicted that the travel time is a significant factor in overall behaviour and selection of the mode of transportation.

3 Discussion

The findings depicted the various interconnected and interdependent factors, which contributes towards the behavioural patterns and approaches of the daily commuters. The financial situation, socially accepted standard of living, habits pertaining to the age, gender and demographic factors, were found to be significant in choosing the mode of transportation between a

car, motorcycle of public transportation. Bangkok is equipped with sky trains and underground rail network, which provides for faster mode of transportation. On the other hand, individual vehicle owner found it difficult to travel with consistent traffic jams and high pollution levels.

These findings support the previous literatures among the other countries and were found to be related with studies from European countries [40-42], developing economies such as Mexico [43-44] and Asian countries [45]. The comparative analysis between the other countries enhances the adequacy towards the adoption of accurate governmental initiatives to enhance the ease and comfort of the daily commuters in Thailand. It was observed that Thailand lacks the governmental planning to tap upon the daily commuters. Integrated combined efforts from the governmental factors, as well as demographic, social and economic factors, provided for the in-depth analysis from this research [46-47].

The following is the SWOT analysis performed to ascertain the situational analysis based on the content analysis of the selected factors (r Figure 5).

Strengths: One of the major strengths in Thailand is its developed public infrastructure with existing public transportation structure in almost every corner of the country. The connectivity is adequate due to the high reliance on the tourism and logistics sector of the economy. In terms of paying capacities of the general population, Thailand enjoys high purchasing power among its citizens. This provides for positive intension among general population in Thailand to spend adequately for transportation expenses. However, the income level of each individual results in different behavioural approach towards choosing the mode of transportation. Another strength of public and private transportation is the security [48]. The public transportation inclusive sky trains and underground

train system are very secure with government policies for screening of each passenger.

Weaknesses: The major factor that affects the choice of the daily commuter, is the travel time and travel costs. There are several financial limitations in the public transportation system. The factor, which affects directly upon the choice of mode of transportation is the overdependence on social stigma. The social perceptions have an adverse impact on the habits of the daily commuters as they are drawn more towards the individually owned vehicles rather than using the public transportation.

Opportunities: The government interventions through adequate policies would positively impact the commuters and they would in turn enhance government revenues. Several schemes could be adopted by the public and private transportation. For instance, economical monthly pass for the students, daily commuters and frequent travellers. The government could utilize the public transportation mediums as a means of reducing and minimizing the environmental issues in the Bangkok Metropolitan Area. The reduced vehicles on the roads reduced carbon emissions, reduce probability of road accidents and enhance the overall traffic management system of the area.

Threats: Despite all the current policies, efforts and presence of the defined public transportation system, there is a gap between the adequate transportation behaviour, which results in mismanaged traffic jams and inconsistent public transportation. The recent high pollution levels are major concerns as the population in Bangkok Metropolitan Area had to wear facemasks even before the COVID-19 pandemic occurred. The overall perception of the private vehicle ownership is deeply imbedded among the general population in Thailand. This diminishes the attractiveness of the public transportation channels.

The SWOT analysis provided for the distinctive factors that would be essential to improve the sustainable travel choices among the Thai population [49]. The factors included the demographic, economic, social and policy level implications that were observed during the research. The interdependent factors are analysed with the interconnected factors for the overall analysis and recommendations.

4 Recommendations

The results of this study provided for following recommendations, which are divided into policymakers and daily commuters, government and individuals, respectively.

4.1 Recommendations for government

1. Revision of public transportation policies in terms of

economic viability of recurring travel.

2. Empowerment or provision of beneficial travel schemes for daily commuters.
3. Improvement of the public transportation vehicles in order to attract the daily commuters.
4. Reduction of the travel time and travel costs through adequate travel route planning inclusive of suburban areas.
5. Enhanced affordability, accessibility and connectivity of public transportation to avoid social exclusion.

4.2 Recommendations for individuals

1. Awareness of environmental impacts rather than the societal status through being owner of a private vehicle.
2. Economic benefit analysis of all the public mode of transportation available.
3. Usage of monthly pass and student discount travel card in the public transportation systems in Bangkok Metropolitan Region.
4. Education regarding the environmental, economic and social impacts of individual mode of transportation.
5. Enhanced usage of carpooling.

5 Conclusion

The study finds out that the most significant factors under the perception of the daily commuters are travel time, travel cost and the comfort level of the individuals. Thailand has been dealing with transportation issues and corresponding environmental degradation in the recent times. Therefore, this research presents the analytical approach towards reduction of pollution and effective traffic management through analyzed travel behaviors of the daily commuters. The government must implement adequate policies and schemes towards enhancing the participation of daily commuters towards the public transport. This needs to be amalgamated along with reduced travel time to cover maximum travel distance at the most economical price and highest comfort level. Such an adequate policy and effective implementations would benefit daily commuters as well the development of the government infrastructures and growth of the Thai economy. This paper contributes to the academic literature of travel studies, through a consideration of the developing, Southeast Asian country's environmental and cultural aspect.

6 Way ahead

The research paves the way for micro level quantitative research and leads up further research into

the environmental impacts of planned travel behaviours and overall implications leading to the high pollution in the Bangkok Metropolitan area. Likewise, the study

could be further analysed for different demographic, social and economic set up among the developing countries.

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