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Assessment of Campus Bus Service Efficacy: An application towards green environment

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Abstract

Environmental issues on public transport and greening the campus for sustainability have been the priorities for Malaysian public universities, particularly in ensuring the efficiency and effectiveness of the bus service. The study focused on twelve universities (N=8000) in the Klang valley, Selangor, Malaysia. Also, interviews with university transport officers presented the qualitative aspects for data triangulation. Results from the analysis provided the empirical evidence for campus bus service efficacy leading towards a greener and conducive environment on the university grounds. Greening the campus should be a shared core responsibility where all stakeholders should take an active part in environmental care.

Keywords: Environment; campus bus service; student satisfaction; green campus

1. Introduction

With climate change and global warming, environmental issues in public transport have grown in importance in recent years. In response, some organizations have been proactive to demonstrate their 'green' credentials through corporate social responsibilities (Avineri 2012). Similarly, greening the campus for sustainability has been a priority for Malaysian public universities. The awareness towards

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preserving the pristine university environment stimulated the need to study the bus services plying the campus routes (Limanond, Butsingkorn et al. 2011; Delmelle and Delmelle 2012). Moreover, emphasis and attempts at greening the campus environment are in tandem with the factorial increase in the university student population as is the case of Universiti Teknologi MARA, Shah Alam, Selangor, Malaysia. As an initial measure, focus was on the campus shuttle service efficiency where the regular passengers are the students living in dormitories on campus.

Environmental issues on public transport and greening the campus for sustainability have been the priorities for Malaysian public universities, particularly in ensuring the effectiveness and efficiency of the bus service (Hashim, Haron et al. 2013). With transport services, literature reviewed showed that the latter element encompasses the former. Therefore, several aspects of efficacy need to be grounded. Starting with a small but focused area, the findings from the study can be expanded to metropolitan and rural areas (Delmelle and Delmelle 2012). By doing so, the concepts pertaining to the logistics and economics of transportation can also be impactful. Sustainable urban transport planning is intended to ensure balanced access to travel needs among social groups without compromising the accessibility for the next generation's mobility needs (Debnath, Mazharul Haque et al. 2011). Issues such as infrastructure and policy-oriented questions will lead to a better understanding of the effects of taking particular actions, including the behavioral response to policy initiatives on transport and ridership (Ceder, Chowdhury et al. 2013; Croissant, Roy et al. 2013).

All the same, bus services should become a solution for sustainable transport in future whether on university campuses or other populated areas (Krizek 2012; Haque, Chin et al. 2013), for example, in cities like Shah Alam and Kuala Lumpur. In almost all university campuses in Malaysia, students rely heavily on public transport. Poor quality services of the campus bus services will cause students to miss classes, waste precious time and discourage them from riding the shuttle buses. Added to that, other discomforts such as tardiness of bus services, unpleasant rides, as well as issues on safety and unsupportive bus personnel, fuels the bus users' negative perception on campus-provided transport services (Hashim, Haron et al. 2013).

Nonetheless, most students living on campus are highly dependent on public transportation specifically the bus services. For the main campus of Universiti Teknologi MARA (UiTM) located in Shah Alam, Selangor, the university policy states that students who are given dormitories are not allowed to bring their own vehicles as they can either walk or ride the campus-plied buses. This ruling, if strictly enforced, helps reduce daily traffic congestions on campus. Even though this may seem a prejudiced decision for the affluent students, the privilege accorded to the lucky ones with regards to dormitories cannot compete with the luxury of being close to their lecture halls. On the other hand, those who chose to live off campus are faced with other economic costs involved in maintaining their private vehicles (Hashim, et al, 2013).

2. Background

Greening the campus should be a shared core responsibility among the university populace. To care for the natural infrastructure and the well-being of everyone associated with the university should be a joint effort. In the case of Malaysia, with the factorial increase in student population many public universities in the Klang Valley are hard-pressed to ensure that the shuttle bus services plying the campus routes are run efficiently. Hence, the purpose of this paper is the provide insights on the students' satisfaction towards their university's bus services. Students from twelve public universities located within the parameters of the Klang Valley formed the scope with a sample size of 8,000. The choice of the Klang Valley is apt as this geographical expanse is the most populated area in Malaysia where public buses are the most popular choice of rides followed by light rail and commuter trains (Kamaruddin 2012).

Furthermore, greening the campus environment is not a one-man show. All parties, including governmental institutions, student bodies, should take an active part, enabling industry to co-create a macro transport development in the region and to influence future legislation of green issues in the transport sector, with an aim to establish green transport routes (Yang and Lau 2007; Willoughby 2013). There is a strong need to regulate green logistics issues in the Klang Valley; therefore, additional studies and proposals will be necessary in the future. For starters, university campuses were the focus of this study as many of them are located in and around the metropolitan area of Kuala Lumpur. From here, the study can be replicated to include the urban, sub-urban and rural transport infrastructure and logistics throughout other locations in Malaysia. These are key aspects to take into consideration when developing indices to evaluate transport service quality as well as to determine how much weight the passengers' feedbacks give to each attribute in the assessment of service quality (SQ) (Banister 2008; Sharaby and Shiftan 2012).

3. Method

3.1. Research design

As indicated in the research objectives, the project was to assess the efficacy of the campus bus service at twelve public universities in the Klang Valley, Selangor, Malaysia. The list of universities are shown in Table 1. As such, the research design used for this investigation is cross-sectional or one-off using questionnaires to collect primary data. In addition, interviews were also conducted with the transport officers at the universities identified.

Table 1. Sample size - The list of universities in the Klang Valley

No.	Location on Map (Fig. 1)	University Name	Status
1	A	Universiti Malaya (UM)	Public/Research University
2	K	Universiti Kebangsaan Malaysia (UKM)	Public/Research University
3	G	Universiti Putra Malaysia (UPM)	Public/Research University
4	D	Universiti Teknologi Malaysia (UTM)	Public/Research University
5	H	International Islamic University Malaysia (IIUM)	Public University
6	B	Universiti Teknologi MARA (UiTM)	Public/Comprehensive University
7	F	Universiti Sains Islam Malaysia (USIM)	Public University
8	L	Sultan Idris Education Universiti (UPSI)	Public/Teaching University
9	I	Universiti Kuala Lumpur (UniKL)	Private University
10	J	Universiti Tenaga Nasional (UNITEN)	Private University
11	E	Malaysia Multimedia University (MMU)	Private University
12	C	Open University (OU)	Private University

3.2. Sampling techniques

A two-stage sampling technique was employed for this project. Firstly, stratified sampling was determined in order to select the universities within a specific location, which in this case is the Klang

Valley, Malaysia. The locations of the universities are shown in Figure 1. The map shows locations of the major universities within a radius of 50 kilometres; this is an opportunity that will allow a major bus or coach operator to service the campus through private partnership scheme between the university campus and the operator. Large scale operations will allow the operator the benefit of economies of scale to invest on green strategies on vehicle design, bus-drivers recruitment, training and optimum utilisation of resources through strategic routing and scheduling.
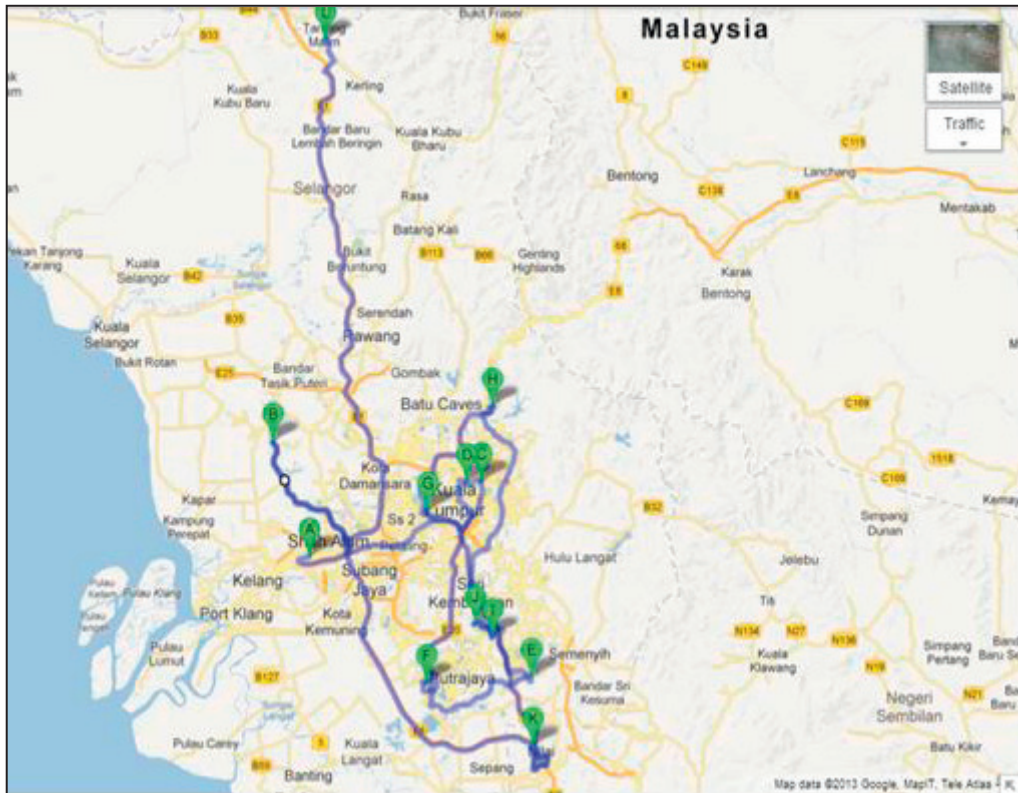

Fig. 1. Locations of the 12 universities in the Klang Valley

3.3. Data collection and instrument

A survey form or questionnaire was used to collect data from the sample respondents, the university students. The instrument is divided into two parts where Part A contains the demographic profiling whilst Part B has 29 statements listed for obtaining responses set on a scale of one (extremely dissatisfied) to five (extremely satisfied). Also, two open-ended questions were included for personal comments and opinions by the respondents on improving the campus bus services. Prior to the actual data collection in December, the instrument was piloted in November 2012. Consequently, the reliability analysis for the instrument resulted in a Cronbach Alpha coefficient of 0.820, suggesting that the 29 items have relatively high internal consistency. For the qualitative aspect, an interview guideline was used during the sessions with the transport officers at the twelve universities. The transcriptions were later analyzed based on

pattern coding. Also, the opportunity to meet face-to-face with the officers allowed for more secondary data collection for tabulation and comparative analysis.

4. Findings

From the 8000 questionnaires distributed and administered, the 5883 (73.5%) usable ones were input for data analyses. The breakdown of universities that responded to the survey is shown in Table 2.

Table 2. Breakdown of respondents by university

University	Number of respondents	Percentage
Universiti Malaya (UM)	512	8.7
Universiti Kebangsaan Malaysia (UKM)	611	10.4
Universiti Putra Malaysia (UPM)	553	9.4
Universiti Teknologi Malaysia (UTM)	350	5.9
International Islamic University Malaysia (IIUM)	540	9.2
Universiti Teknologi MARA (UiTM)	2161	36.7
Universiti Sains Islam Malaysia (USIM)	167	2.8
Sultan Idris Education Universiti (UPSI)	321	5.5
Universiti Kuala Lumpur (UniKL)	67	1.1
Universiti Tenaga Nasional (UNITEN)	601	10.2
Malaysia Multimedia University (MMU)	-	-
Open University (OU)	-	-

From Table 2, since there are no responses from the Malaysia Multimedia University and Open University, both universities were automatically eliminated. From the remaining 10 universities, the modal split, that is, the students' main transport choice to campus is shown in Table 3, where 51.8% prefers to commute on the campus buses, followed by 20.9% of students who drive to school and 20.7% of bike riders.

Table 3. University students' modal split

Transportation to Campus	Frequency	Percentage
Car	991	20.9
Taxi / Cab	124	2.6
Bus	2455	51.8
Motorbike	981	20.7
Other transportation	431	9.1

Next, Table 4 showcases the gender distribution of respondents, where Universiti Teknologi Malaysia (UTM) displayed a high 50.9% of male respondents. However, this percentage only applies to UTM but not for the actual count where Universiti Teknologi MARA (UiTM) had 611 male respondents and 1550 of the opposite gender. The second most number of respondents after UiTM is Universiti Tenaga

Nasional (UNITEN) with 426 male and 175 female students, followed by the International Islamic University Malaysia (IIUM) with 254 male and 286 female respondents. The least number of respondents were from a private institution, University Kuala Lumpur(UniKL) with 29 male and 38 female repondents.

Table 4. Gender distribution of respondents

University	Male (%)	Female (%)
University Malaya (UM)	200 (39.1)	312 (60.9)
Universiti Kebangsaan Malaysia (UKM)	239 (39.1)	372 (60.9)
Universiti Putra Malaysia (UPM)	207 (37.4)	346 (62.6)
Universiti Teknologi Malaysia (UTM)	178 (50.9)	172 (49.1)
Universiti Teknologi MARA (UiTM)	611 (28.3)	1550 (71.7)
International Islamic University Malaysia (IIUM)	254 (47.0)	286 (53.0)
Universiti Sains Islam Malaysia	51 (30.5)	116 (69.5)
Sultan Idris Education Universiti (UPSI)	90 (28.0)	231 (72.0)
Universiti Kuala Lumpur (UniKL)	29 (43.3)	38 (56.7)
Universiti Tenaga Nasional (UNITEN)	426 (70.9)	175 (29.1)

For the campus bus service efficacy, the mean scores for the 29 items including the overall bus service scores are shown in Table 5, where the highest mean score of 3.42 is for Directness of Route, followed by State of Campus Road at 3.40. The Cleanliness of the Buses averaged 3.39 and three statements average 3.33, which are Ease of Paying Fare, Behavior of Other Passengers and Personal Safety on Bus. However, the most important aspect was the Overall Bus Service with a mean score of 3.24 (from a maximum of 5), thus depicting that the campus bus services for the ten universities is commendable. The discussions and implications on the findings will be elaborated in the next section.

Table. 5. Mean score of campus bus service efficacy based on 30 items

No	Universities	Mean	SD
1	Overall Bus Service	3.24	0.954
2	Value for money	3.31	0.966
3	Frequency of service	3.10	0.972
4	Punctuality	2.84	0.987
5	Reliability of bus service	3.07	0.923
6	Waiting time	2.77	0.985
7	Directness of route	3.42	0.900
8	State of campus road	3.40	0.937
9	Safety at bus stop	3.30	0.959
10	Cleanliness at bus stop	3.16	0.997
11	Condition bus stop	3.19	0.978
12	Accessibility of bus stop	3.32	0.915
13	Information prior to Travel	3.18	0.909
14	Information prior at bus stop	3.14	0.950
15	Destination Panels (notice Board) at bus stop	3.16	0.969
16	Cleanliness of bus	3.39	0.942
17	Condition of bus	3.37	1.092
18	Availability of seating on bus	3.12	1.003
19	Availability of storage bus	3.14	0.957
20	Temperature/humidity on bus	3.32	0.951
21	Ease of paying fare	3.33	0.906

22	Behaviour of other passengers	3.33	0.893
23	Personal safety on bus	3.33	1.055
24	Ease of boarding/alighting bus	3.30	0.908
25	Provision and visibility of handrails, etc	3.26	0.898
26	Demeanour (behaviour) of bus driver	3.22	0.952
27	Quality of driving	3.22	0.969
28	Shelter provision (when it rains)	3.12	1.014
29	Street Lightening	3.28	0.980

5. Discussions and implications

The impetus for this research project came from observations on traffic conditions and the different transport management from the universities. Standardization was the goal but after presenting the findings to the funding agency, several issues and resolutions were agreed upon by the stakeholders such as the Bumiputera Agenda Steering Committee (TERAJU), the Ministry of Higher Education-Malaysia, the Economic Planning Unit (EPU), the Land Public Transport Commission (SPAD), Malaysia. In line with the government's Economic Transformation Program (ETP) on Greater KL, that is, ascertaining that public transportation is the people's mobility choice, then such a strategy should be promoted further by the administration. Nevertheless, the results revealed significant implications such that:

- 51.5% of the students use campus bus, 21.9% of students use the motorbike, 20.4% of students uses car, 2.5% students use taxi and 8.9% students use other transportation. The university transport department should be relieved with this outcome as students prefer that campus shuttle more than other alternatives. However, further improvements to the bus services should be continuously done and quality should not be compromised.
- The ridership between peak hours and off peak hours varies significantly – this is a normal occurrence as economic costs related to each vehicle put on the road should be critically evaluated based on peak periods. The university transport officers should monitor the situation and observe whether there is equilibrium in demand and supply. It should be noted that Universiti Teknologi MARA has the highest number of student population at the main campus, therefore, benchmarks could be set on shuttle service efficiency.
- Due to lack of capacity, all public universities outsource shuttle services to contract bus operators. University administrators have weighed the costs of buying more buses or outsourcing them. With the latter, maintenance and other costs on the vehicles are not weighed on them. Furthermore, outsourcing of buses is a logical and practical decision depending on usage.
- The student satisfaction with the campus bus service is above average (3.24 from a maximum of 5) – this is evidenced in the overall mean score shown in Table 5. Nonetheless, other aspects pertaining to campus shuttle service must be improved for example the punctuality and reliability of the buses, the shelters at the bus stops when it rains and seating capacity. The latter is an important issue to look into because of the increasing number of students. Be it at the bus stops or on the bus itself, seating capacity for most campus buses is 40 but most times passengers exceed that number during peak periods. Students rushing to classes will cram and overload the maximum seating capacity of the bus, hence, safety and comfort issues will arise. Consequently, more buses will be have to be provided by the university transport department to meet the high demand. Often times, the university-operated buses will be exhausted, thus, outsourced ones will be used to ply the campus routes.
- Managing campus population transportation needs require thorough provisions where an efficient campus bus service would not only increase their accessibility to activities, but ensure greener environment through reduction in private car use that may cause congestions at the entrances and exits and along campus roads. Most campus trips are less than five kilometers, thus a campus circle bus or

campus shuttle buses are more practical. The use of bus services by the campus community will reduce campus carbon foot-print tremendously, more so if the bus services are operated on a green concept, that is, green driving manners, green engine, green fuel and green design. However quantifying the gain will require further analysis depending on campus policy and adaptation to green agenda (Krizek 2012).

- Greener policies can be designed for campus mobility with greener engine and design for buses where top universities can lead the way through campus transformation into living laboratories with many innovative activities.

Further implications from this study showcase valuable insights on the need to standardize the transport management system for the public universities but private universities have full autonomy over their transport administration. In addition, while most campus citizens are subconsciously aware of the need to care for the campus environment, university administrators should implement and enforce their strategic plans to green the campus and for the initial step, the shuttle services should be beefed towards this important agenda. The findings from this project are similar to one done by Gujba, Mulugetta et al. (2013) where the results clearly demonstrate that future transport policy for university campuses should promote this mode as a popular and convenient option. At the same time, incentives to ride the buses rather than to drive personal vehicles will lean towards a more environmentally and economically sustainable option besides walking and bicycling (Norzalwi and Ismail 2011). With the increasing awareness on being environmentally conscious, campus communities will find the motivation to work in conducive and green surroundings.

6. Conclusion

As a conclusion, the study provided the empirical evidence on campus bus service efficacy as well as the green gestures in ensuring a sustainable environment. Results from the analysis provided the empirical evidence for campus bus service efficacy leading towards a greener and conducive environment on the university grounds. Greening the campus should be a shared core responsibility where all stakeholders should take an active part in environmental care. This can influence future legislation on environmental issues with the aim of establishing green transport infrastructure. To reiterate, there is a strong need to regulate green logistics issues on university campuses in the Klang Valley.

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This paper presents the life cycle environmental impacts and economic costs of the passenger transport sector in Nigeria for 2003-2030. Four scenarios are considered: business as usual (BAU); increased use of public transport (buses) at the expense of cars (LOWCAR) and motorcycles (LOWMC), respectively; and high economic growth with increased car ownership and decline of public transport (HICAR). The findings show that for the BAU scenario the life cycle environmental impacts double over the period, despite the assumption of increased fuel and vehicle efficiency of 35% over time. The total fuel costs at the sectoral level increase three times, from US$3.4 billion/yr in 2003 to US$9.7 billion in 2030. Increasing the use of buses would reduce the environmental impacts on average by 15-20% compared to BAU; at the same time, the total fuel costs would be 25-30% lower. If the use of cars grows much faster due to a high economic growth as in HICAR, the environmental impacts and fuel costs would increase by 16% and 26%, respectively. These results demonstrate clearly that future transport policy in Nigeria should promote and incentivise public (bus) transport as a much more environmentally and economically sustainable option than transport by cars and motorcycles. (C) 2012 Elsevier Ltd. All rights reserved.

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In order to encourage the usage of public transportation in university campus, the service itself should be improved in the first place. This paper discusses the pattern of mode trip and the perception of current in campus transportation services from the point of view of campus community. From 288 out of 300 questionnaires, 13.6 % of responses came from UKM campus staff (faculty and university department) and 86.4% from students (undergraduate and postgraduate). Results show that there are about 18% of the campus community walking, 31% ride campus bus, and the rest 50% use private transportation to travel to the campus. Most of the campus community preferred walking within the distance of 100 meters and below for on-campus trip, but the travel modes varies when the trip distance exceeds 100 meters. Schedule inefficiency and comfortably level are being addressed as the main problems faced by the public transportation users in the campus. [ABSTRACT FROM AUTHOR]

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