

**INTEGRATED FARE PAYMENT SYSTEM IN MULTI OPERATORS
SINGLE MARKET PUBLIC BUS NETWORK**

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MARKET PUBLIC BUS NETWORK

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Specially dedicated to

*To my beloved father, mother and sisters,
Mohamad Yusoff and all my friends,
my entire lecturers,
for the support and cares.*

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ABSTRACT

Several research have dealt with the need for the planning of an efficient public transportation system in Johor Bahru. However, these research did not look into the need for efficiency of public transportation from the perspective of the users' and operators' and the efficiency of the fare payment system among the stage bus operators. Studies have identified that fare integration is a way to enhance public bus system. Therefore the aim of this study is to determine if the fare integration would enhance public bus system in Johor Bahru. The objectives of the study were to review the current operational, network and market structures of public bus system in Johor Bahru, to determine users and operators acceptance level to the integrated fare payment system, to determine the appropriate methods of fare integration and to review the benefits of the integrated fare payment system. Seventy stage bus users and three bus operators were interviewed. The research hypotheses (alternative hypothesis H_1) stated the population parameter (age, education and income level) and travel characteristic (changes of bus line) have influence to the acceptance of the integrated fare payment system against the study hypotheses (null hypothesis H_0) that the population parameter and travel characteristic have no influence to the acceptance of the integrated fare payment system. Hypotheses test failed to reject the null hypotheses (for age, income level and changes of bus line) and accepted the alternative hypothesis for education level. For the operators, the research hypothesis was on the population proportion (P) where the alternative hypothesis $H_1: P > 0.5$ tested the operators willingness (willingness to share information and merge) against null hypothesis $H_0: P = 0.5$. Hypotheses test accepted the null hypothesis for both of the proportion hypotheses. The proportion test value ($P = 0.2776$) revealed there is inadequate evidence to conclude that operators are willing to share the information and merge ($P > \alpha$). The result is inconclusive as the study only evaluated three population parameter (age, education and income level) and one travel characteristic (changes of bus line). Further research in population and travel characteristics is needed for more complete understanding on users' and operators' acceptance level to the proposed integrated fare payment system in Johor Bahru.

ABSTRAK

Beberapa kajian telah mendapati keperluan untuk merancang pengangkutan awam yang efisien di Johor Bahru. Namun kajian tersebut tidak melihat keperluan pengangkutan awam yang efisien dari perspektif penumpang dan operator bas mahupun dari sudut tambang diantara operator bas. Kajian telah mengenalpasti aplikasi tambang bersepadu adalah salah satu kaedah untuk memperbaiki pengangkutan awam di Johor Bahru. Objektif kajian ini adalah untuk mengenalpasti operasi, rangkaian dan stuktur pasaran semasa pengangkutan awam di Johor Bahru, untuk menentukan tahap penerimaan penumpang dan operator terhadap sistem tiket bersepadu, untuk mengenalpasti kaedah tambang bersepadu yang bersesuaian, dan untuk mengenalpasti kebaikan penggunaan tambang bersepadu. Tujuh puluh penumpang dan tiga operator bas disoalselidik. Kajian hipotesis (hipotesis alternatif H_1) menyatakan ciri-ciri penduduk (umur, taraf pendidikan dan pendapatan) dan ciri-ciri perjalanan (pertukaran bas) mempunyai pengaruh kepada tahap penerimaan sistem tambang bersepadu bertentangan dengan hipotesis nol (hipotesis nol H_0) yang menyatakan ciri-ciri penduduk dan perjalanan tidak mempengaruhi tahap penerimaan sistem tambang bersepadu. Ujian hipotesis gagal menolak hipotesis nol (untuk umur, pendapatan dan pertukaran bas) dan menerima hipotesis kajian untuk taraf pendidikan. Untuk operator bas, hipotesis kajian adalah berdasarkan ujian perkadaran dimana $H_1: P > 0.5$ untuk mengetahui kesanggupan operator bas (kesanggupan berkongsi maklumat dan bergabung) bertentangan dengan hipotesis nol $H_0: P = 0.5$. Ujian hipotesis menerima hipotesis nol untuk kedua-dua ujian hipotesis perkadaran tersebut. Nilai perkadaran ($P = 0.2776$) mendedahkan ujian hipotesis tersebut kekurangan bukti untuk membuat kesimpulan bahawa operator bas sanggup untuk berkongsi maklumat dan bergabung ($P > \alpha$). Keputusan kajian ini tidak memberikan keputusan kerana skop kajian terhad kerana hanya merangkumi tiga ciri-ciri penduduk (umur, taraf pendidikan dan pendapatan) dan satu ciri-ciri perjalanan (pertukaran bas). Kajian lanjutan dalam ciri-ciri penduduk dan perjalanan diperlukan untuk lebih memahami tahap penerimaan penumpang dan operator bas terhadap sistem tiket bersepadu di Johor Bahru.

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LIST OF ABBREVIATIONS

ARS	-	Automatic Response Systems
ATM	-	Automated Teller Machine
CBD	-	Central Business District
CD	-	Usage Data
		Co-operative Development
CPU	-	Central Processing Unit
CVLB	-	Commercial Vehicle Licensing Board
DART	-	Delaware Authority Regional Transportation
DB	-	Data base
DCS	-	Depot Computer System
EEPROM	-	Electrical Erasable Program
EIFS	-	Enhance Integrated fare system
EMV	-	Europay, Mastercard and Visa
GPS	-	Global Positioning System
GTM	-	General Ticketing Machine
IC	-	Integrated Circuit
IDFC	-	Integrated Drivers Fare Console
IFPS	-	Integrated Fare Payment system
ISO	-	International Organization for Standardization
ITS	-	Intelligent Transport system
KL	-	Kuala Lumpur
KTM	-	Keretapi Tanah Melayu
LAN	-	Local Area Network
MARTA	-	Metropolitan Atlanta Rapid Transit
MECD	-	Ministry of Entrepreneur and
MOT	-	Ministry of Transport
MOW	-	Ministry of Work

NYCT	-	New York City Transit
O.M.O	-	One man Operator
PDA	-	Personal Data Acquisition
PR	-	Public Relation
RAM	-	Random Access Memory
RF	-	Radio Frequency
ROM	-	Read Only Memory
S.M.G	-	Seoul Metropolitan Government
SDI	-	Seoul Development Institute
SMG	-	Seoul Metropolitan Government
TBS	-	Seoul Broadcasting System
TMA	-	Transport Management Associations
TSM	-	Transport System Management
UTAUT	-	Unified Theory of Acceptance and use of Technology

LIST OF SYMBOLS

\hat{p}	-	The sample proportion
x	-	The characteristics of interest
n	-	Sample size
α	-	Type I error, significant level
β	-	Type II error
P	-	The population proportion
H_0	-	The null hypothesis
H_1	-	The alternative hypothesis
Z	-	The normal test statistic

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CHAPTER 1

INTRODUCTION TO RESEARCH

1.1 Background

Public bus is seen as a practical answer to the current traffic congestion woes in major Malaysian cities. The daily congestion in cities like Kuala Lumpur, Johor Bahru and Georgetown are the results of the heavy reliance on private vehicles as the main transportation mode among the citizens. Statistics from Road Transport Department showed a percentage of steady increase of private car ownership by Malaysian all over the country from the year 1999 until the year 2005 (Figure 1.1).

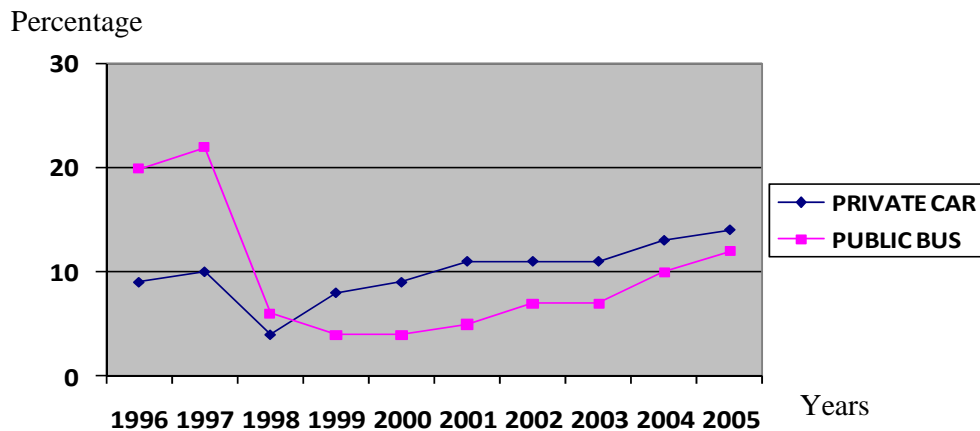


Figure 1.1: Percentage of registered private car and the public bus in Malaysia from year 1996 to year 2005

Source: Road Transport Department (2006)

The undesirable impacts from this congestion include the increase in travelling time and cost, higher probability of crashes, escalating environmental pollution, and many others including the increase in unsightly infrastructure development. Hence, the authorities know that a more sustainable form of transportation like the public bus must be given higher priority over private vehicles usage, if all these negative impacts are to be reduced.

There are no shortcuts in the success stories on public bus usage in major world cities. They are Kyoto in Japan, Seoul in South Korea and Curitiba in Brazil. Some of these successes do not come easy, fast nor cheap. Most successes include a major reform on the way of thinking among city officials, bus operators, financial institutions and the public. This reform requires great will to succeed from all these stakeholders. But, their effort can be made easier with the help of technology. In fact, in most cases, the use of technology is crucial and instrumental in getting the support of the people who ultimately must decide whether to shift to the public bus or to continue to rely on their trusted private vehicles.

There are many technologies available these days to help and support the implementation of a public bus service. These technologies include Advanced Traveller Information System (ATIS), Advanced Traffic Management System and Advanced Public Transportation System (APTS) that could facilitate the planning of a bus operation in a big city that admittedly can be very complicated (Lam and Toan, 2006). These technologies help to reduce over dependencies on human or manual judgment when managing large network as well as to improve users experience when using the public buses. Putting them together require great skill and intelligence but the success is sweet and rewarding as all these efforts help to encourage more sustainable development and more quality living.

1.2 Problem Statement

The current implementation of the public bus systems in Malaysia can be categorized as a multi operator single market system where several bus operators competing for the same market segment. For example, in Johor Bahru, the residents of Taman Universiti are spoilt for choices as almost all operators in Johor Bahru such as Causeway Link, Triton, Maju, Transit Link and others offer their services to Taman Universiti. As there are many operators, the competition among them can be rough. This phenomena result in a host of other problems including services provided and network disintegration which will not benefit each competing operator.

However, save for the above problems, there is still one common ground that holds all these operators together which is the fare system. In Malaysia, fare is highly regulated and it is the function of the government through the Commercial Vehicle Licensing Board to control it. Individual operator does not have the legal rights to change their fare or alter the fare structure. Hence, if other things remain status quo (e.g. operation, market and network structures), then improving the fare payment system is a possible solution to improve the attractiveness of the public bus system especially when the government, either federal or local, has full control over it.

All public transport operators ought to follow Section 19 Commercial Vehicle Licensing Board Act 1987. The Act is as follows:-

19. (1) Subject to this Act, the Board may attach to any license granted under this Act such conditions as it think fit and in particular –

(a) in relation to a specified class of public service vehicles license –

(i) that specified fares shall be charged;

(ii) that where desirable in the public interest, the fares shall be so fixed as to prevent wasteful competition with alternative means of transport , if any , along the route or any part thereof or in proximity thereto;

(iii) that the service shall be operated within the specified areas or routes and in accordance with specified hours of operation and specified frequency;

- (iv) that copies of the time-table and fare table and in the case of excursion hoses also the itinerary , shall be carried and displayed in vehicles used on the service and shall be liable for inspection;*
- (v) that passengers shall not be taken up or set down except at points specified in the license or shall not be taken up or set down between specified points;*
- (vi) that passengers in excess of a specified number shall not be carried;*
- (vii) that the holder of the license or certain specified persons only shall drive or operate the vehicle;*

Source: Commercial Vehicle Licensing Board Act (1987)

No consideration has been given to the fare payment system when it comes to planning the public transportation in Johor Bahru. The current fare payment system in Johor Bahru still uses the one man operation (O.M.O) system that far from the latest fare technology and more convenient to the passengers. Based on the premise that the fare system is government-controlled, therefore it would be the easiest way to perform any improvement to the fare payment system. Hence, the integrated fare payment system among various public bus operators could be seen as the good improvement to enhance Johor Bahru public bus system.

1.3 Research Objectives

The objectives of this research are:

i. To review the current operational, network and market structures of the public bus services in Johor Bahru.

This research sought to describe clearly the present public bus daily service operations, the bus network and current method of fare collection. It also seek to examine the characteristics of market structure in order to determine the current market structure for public bus in Johor Bahru.

ii. To determine the acceptance level of the users and the operators of public bus services regarding the integrated fare payment system.

Upon knowing the acceptance level from operators and passengers, recommendations can be made to implement the proposed integrated fare payment system.

iii. To determine the appropriate method of fare payment integration.

There are many ways to implement the integrated fare payment system. Each of the methods has its advantages and disadvantages that should be reviewed to obtain the suitable system of fare payment integration suitable for the current Johor Bahru bus operations.

iv. To review the benefits of an integrated fare payment system.

There are many advantages that could be gained by the operators and passengers such as shorter travelling time, faster boarding and alight time, etc. However, this research does not only seek to determine the benefits to the passengers and operators, but also the benefits to the government and the environment.

1.4 Research Questions

The following questions arise from the research problem stated earlier:

- i. What are the current operation, market and network structures of the public bus services in Johor Bahru?
- ii. What are the experiences in other countries in implementing their integrated fare payment system?
- iii. What will be the best integrated fare payment system for the public bus services in Johor Bahru?
- iv. Will the users and the operators accept the proposed integrated fare payment system?
- v. How can an integrated fare payment system be implemented in Johor Bahru's public bus systems?
- vi. Will the integrated fare payment system benefit the operators and the users?

1.5 Research Methodology

Based on the research problem and research questions, this study was involved the following activities:

1.5.1 Literature Review

Articles on the integrated fare payment system are a good source to know the impetus for their implementation as well as understand the various issues surrounding their implementation. Also, these articles highlighted the different types of integrated fare payment systems as well as highlighted their benefits and shortcomings. This step, therefore help to identify the best solution for the public bus systems in Johor Bahru as well as guide the activities of the research.

1.5.2 Data Collection

It is envisioned that the data for this study come from two sources, primary and secondary. The primary data was obtained from both the users as well as from the operators of the public bus services. The main tools for obtaining the primary data are pre-prepared questionnaire forms. For the users of public bus services, a random sample were selected, the size of sample was determined later in the research. As for the public bus operators in Johor Bahru, a census involving all the operators was conducted as their number is small (less than 10 operators).

The secondary data in this research was obtained from various published sources like from the Department of Road Transportation, Commercial Vehicles Licensing Board, Ministry of Transportation, Local Authorities such as Johor Bahru City Council and Central Johor Bahru Municipal Council and also the Statistics Department.

1.5.3 Data Analysis

This step was analyzing the data obtained both from the primary and secondary sources. The data from the secondary sources was mainly involved with descriptive statistics as their roles were chiefly to explain the current operation, network and market structures.

The primary data however was analyzed using either the parametric or non-parametric inferential statistics. Also, some form of measures of association like the contingency coefficient which was used to explain the bivariate relationships that might exist between two variables. These statistical analyses were important to test the hypotheses stated in this research.

1.5.4 Findings and Conclusion

The last stage of the research is to provide the summary of the research, the conclusion and create some recommendations for future research. The research will draw to the attention to the improving the fare payment system.

Furthermore, this chapter also provided several aspects for future research such as integrated fare payment system between different modes of transportation in Johor Bahru, the different aspects of passenger characteristics to be evaluated, the study of policies and strategies needed by the authorities in implementing the integrated fare payment system, the study on the fare structure, the charging the fare pricing, the fare revenue collection and the revenue allocation among the different operators involve with the integrated fare payment system.

1.6 Research Hypotheses

Based on the research questions outlined in the previous section, this research examined the following two hypotheses:

- i. Most users will accept the integrated fare payment system.

The null hypothesis (H_0) indicated that it is not true that the majority of bus users accept the integrated fare payment system at $p = 0.5$ and it tested against the alternative hypothesis (H_1) where it is true that the majority of bus users accept the integrated fare payment system at $p > 0.5$. Therefore:

$$H_0: p = 0.5$$

$$H_1: p > 0.5$$

where p is the proportion of the users that accept the integrated fare payment system.

- ii. Most operators will agree to the integrated fare payment system.

The null hypothesis (H_0) indicated that it is not true that the majority of bus operators agree to the integrated fare payment system at $p = 0.5$ and it tested against the alternative hypothesis (H_1) where it is true that the majority of bus operators agree to the integrated fare payment system at $p > 0.5$. Therefore:

$$H_0: p = 0.5$$

$$H_1: p > 0.5$$

where p is the proportion of the operators who agree with the proposed integrated fare payment system.

Source: Weiss (1995)

1.7 Scope of Research

Proper scoping of the research is required as it is important that the research only provides answers that are sought after. Therefore, the following research scope has been identified:

- i. The research was conducted in Johor Bahru. In Johor Bahru Structure Plan 2001 - 2020, the city plans to have an integrated public transportation system in the southern region of Malaysia. Therefore, the area selected is valuable to set up the city to the future planned system.
- ii. The research was limited to identifying the best solution to implement the integrated fare system but it did not go into the mechanics of how to put the systems into operation. The parts that involved with the technical aspects are not in researcher knowledge. As such, this research was limited to find the best solution to implement the proposed integrated fare payment system in Johor Bahru.
- iii. The integration of the fare payment was only involved bus services and not other modes of transportation like taxi or rail services. Focus was only given to the public bus due to the small number of bus operators in Johor Bahru. The public bus was the best mode of public transportation in Johor Bahru in order to encourage local people to switch from using private car to the public transportation by shifting the fare payment method.

1.8 Significant of Research

This research is significant as its attempts is not only to understand the operational, network and market structures of the public bus systems in a multi-operator-single-market environment but also to explore the acceptance of the users and the operators on the proposed integrated fare payment system. Besides, this research tries to quantify the benefits of such an integrated fare payment system, and also doing to influences the authorities and the operators to adopt the integrated fare payment system.

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