INFORMATION AND COMMUNICATIONS TECHNOLOGY NECESSITY AT AN INTEGRATED BUS TERMINAL IN INDONESIA

Anastasia Caroline Sutandi
Civil Engineering Department
Faculty of Engineering
Parahyangan Catholic University
Jln. Ciumbuleuit No. 94
Bandung 40141, Indonesia
caroline@unpar.ac.id

Wimpy Santosa
Civil Engineering Department
Faculty of Engineering
Parahyangan Catholic University
Jln. Ciumbuleuit No. 94
Bandung 40141, Indonesia
wimpy@unpar.ac.id

Fadil Budi Setianto
Civil Engineering Department
Faculty of Engineering
Parahyangan Catholic University
Jln. Ciumbuleuit No. 94
Bandung 40141, Indonesia

Abstract

The integrated bus terminal as a part of public transportation infrastructure needs to be equipped with the application of communication and information technology, to meet and improve passenger service standards and terminal operational standards. This study aims to evaluate the availability and application of communication and information technology in integrated bus terminals in serving passengers. Based on existing conditions, it is recommended to enhance the application of communication and information technology to improve service to the community. A case study was carried out at the Pulo Gebang integrated bus terminal in Cakung, East Jakarta. Primary data was obtained by using questionnaires and secondary data, namely the number of passengers, the number of bus routes, and the application of communication and information technology, were obtained from the website of the Jakarta Transportation Agency. The analysis results show that the application of communication and information technology is indispensable in integrated bus terminals. In more detail, it was found that the application of communication and information technology in the terminal, with regard to booking tickets through the website or online and the availability of self-ticketing in the terminal, was the most important thing for bus passengers.

Keywords: integrated bus terminal, information and communication, public transportation

Abstrak

Terminal bus terpadu, sebagai bagian prasarana transportasi publik, perlu dilengkapi dengan penerapan teknologi komunikasi dan informasi, untuk memenuhi dan meningkatkan standar pelayanan penumpang dan standar operasional terminal. Studi ini bertujuan untuk mengevaluasi ketersediaan dan penerapan teknologi komunikasi dan informasi di terminal bus terpadu dalam melayani penumpang. Berdasarkan kondisi eksisting, direkomendasikan perbaikan penerapan teknologi komunikasi dan informasi untuk meningkatkan pelayanan kepada masyarakat. Studi kasus dilakukan di terminal terpadu Pulo Gebang di Cakung, Jakarta Timur. Data primer diperoleh dengan menggunakan kuesioner dan data sekunder, yaitu jumlah penumpang, jumlah rute bus, serta aplikasi teknologi komunikasi dan informasi, diperoleh dari laman Dinas Perhubungan Daerah Khusus Ibukota Jakarta. Hasil analisis menunjukkan bahwa penerapan teknologi komunikasi dan informasi sangat diperlukan di terminal bus terpadu. Secara lebih detail diperoleh bahwa penerapan teknologi komunikasi dan informasi di terminal, berkenaan dengan pemesanan tiket melalui *website* atau *online* serta ketersediaan *self-ticketing* di terminal merupakan hal terpenting bagi penumpang bus.

Kata-kata kunci: terminal bus terpadu, teknologi komunikasi dan informasi, transportasi publik

INTRODUCTION

The implementation of Information and Communications Technology (ICT) at an integrated bus terminal is very important to improve service quality to the bus passenger.

The ICT implementation will facilitate community to have information about bus route, bus ticket price, bus name, and bus schedule quicker and easily.

Good service quality at the terminal will increase community demand to use public transportation while doing their daily activities. The purpose of this study is to evaluate existing ICT implementation at integrated bus terminal and then to deliver recommendation to increase the passenger service standard to society. Case study is at Pulo Gebang integrated bus terminal in Cakung, East Jakarta, Indonesia. A number of method, i.e. descriptive analysis method, Importance Performance Analysis method, and hypothetical test are used to analyze the data. Regulation of transportation minister, Republic of Indonesia, number 40 year 2015 regarding standard of land transport passenger terminal service operation and regulation of transportation minister, republic of Indonesia number 132 year 2015 regarding standard of land transport passenger terminal operation used as the guideline of this study. The results of this study can be implemented at other integrated and large bus terminal in Indonesia (JSC, 2017; Ministry of Transportation, 2015a, Ministry of Transportation, 2015b, Sutandi and Hendra, 2016; Sutandi et al., 2017).

In Indonesia, based on the Minister of Transportation Regulations Number 40/2015 and Number 132/2015, integrated bus terminal is type A bus terminal (large bus terminal) that serves bus trip between large cities in a province and among provinces or among countries. This type of terminal is the area wherein people and goods move from origin to destination place. Minimum service standard that implemented to give a good serve to the passenger and to operate terminal daily activity is consist of easiness aspect, reliability aspect, convenience aspect, and security aspect as presented in Table 1 (Martilla and James, 1977; Ministry of Transportation, 2015a, Ministry of Transportation, 2015b).

Table 1 Aspects of Minimum Service Standard at Bus Terminal
(Ministry of Transportation, Republic of Indonesia, 2015a, 2015b)

Aspects	Variable	
	No.	Description
Easiness	1	Easiness to have bus route information in the terminal*
	2	Easiness to have bus schedule information in the terminal*
	3	Easiness to have online bus information (route, schedule, ticket price)
	4	Easiness to book online bus ticket
	5	Easiness to book bus ticket by website/online
Reliability	6	Availability about service information by operator*
	7	Availability about bus delay information*
	8	Availability about terminal layout information*
	9	Availability about self ticketing in the terminal
	10	Availability about real time bus information (route, schedule, ticket price, delay time) on board in the terminal
	11	Availability about real time bus location on board in the terminal
Convenience	12	Availability about wifi or hot spot in the terminal*
Security	13	Facility about security complain service*
Legend: * =		available in the integrated bus terminal

Primary data collected in Pulo Gebang Integrated Bus Terminal (Terminal Pulo Gebang) were data regarding ICT implementation based on passenger's experience and passenger's need using questionnaire. While secondary data is regarding the number of

passenger, the number of buses route, the bus ticket price, and the existing ICT implementation at the terminal were obtained from the website of the Jakarta Agency of Transportation. The data were collected in May 2017.

Pulo Gebang Terminal is located in 12.5 ha area in Cakung, East Jakarta and it has been operated since July 2016. The bus operator names and the bus routes operating at Pulo Gebang terminal, servicing in a province and between provinces in Indonesia, are presented in Table 2. This study only focused on passengers of bus trip between large cities among provinces, because the number of routes and passengers per month is the most.

Table 2 Bus Name and Bus Route Operating at Pulo Gebang Terminal

Bus Trip-Bus Size	Bus Name	Bus Route
In large cities-Small	KWK T 22	P. Gebang–P. Gadung via RW Kuning
	KWK T 29	P. Gebang–P. Gadung via Ujung Krawang
	KWK T 32	P. Gebang–P. Gadung via Auri
	KWK T 25	P. Gebang–RW Mangun via Klender
	KWK JU 01	P. Gebang–Term. Tj. Priok via KBN Cakung
	KWK JU 03	P. Gebang–Term. Tj. Priok via Tipar Cakung
	APB JT 03	P. Gebang–Term. Klender via Pupar Cakung
	KOASI 22A	P. Gebang–Pondok Gede via PD Bambu
Between large cities in a province-Medium	MM T42	P. Gebang–P. Gadung via Jln. Raya Penggilingan
	MM T52	P. Gebang–Kp. Melayu via St. Tebet
	MM T47	P. Gebang–Term. Senen via Cempaka Putih
	MM T506	P. Gebang–Term. Kp. Melayu via Jatinegara
	Bus Trans Jakarta	11 routes in Jakarta City
Between large cities between province-Large	PO among cities	116 bus operators (PO) with many routes among large cities among provinces in Indonesia

Source: Ministry of Transportation (2015a, 2015b)

Table 3 Number of Passenger and Number of Minimum Passenger as Respondents

Month-Year	Number of Passenger (Person)
July-2016	68,740
August-2016	78,654
September-2016	108,598
October-2016	82,597
November-2016	75,692
December-2016	121,994
January-2017	151,794
February-2017	211,599
March-2017	228,897
Average	125,396
Minimum number of respondent n (e=10%)	$n = \frac{125{,}396}{1 + 125{,}396(10\%)^2}$
$n = \frac{N}{1 + N(e)^2}$	$n = 99.92 \approx 100$

Source: Jakarta Agency of Transportation (2017) and Ott and Longnecker (2010)

The number of passengers at Pulo Gebang Terminal and the minimum number passenger as respondent needed in this study is presented in Table 3 (Jakarta Agency of Transportation, 2017). It was determined that the minimum sample size needed for this study was 100 respondents (Ott and Longnecker, 2010). The demography characteristic data of 100 respondents selected for this study is presented in Table 4.

Table 4 Demography Characteristic of Respondents at Pulo Gebang Terminal Jakarta, Indonesia

Characteristic	Number of Respondents (Persentage)
Gender	
Male	83
Female	17
Age	
< 25 years old	31
26–35 years old	27
36–45 years old	17
46–55 years old	18
> 55 years old	7
Education	
< High school	27
High school	38
Higher education	32
Salary (Rp)	
< 1,000,000	11
1,000,000–2,500,000	25
2,500,000–5,000,000	41
5,000,000–10,000,000	17
> 10,000,000	6
Frequency of using bus per week	
First time	26
2–6 times	29
7–11 times	10
12–16 times	6
> 16 times	29
Reason of using bus	
Have no vehicle	16
Cheaper	22
More secure	8
More convenience	36
Other	18

The methods used for data analysis are the Important Performance Analysis method and Hypothetical test. The Important Performance Analysis method used to provide values of level of satisfactory and level of necessity of ICT implementation, whereas hypothetical test was used to evaluate relationship between respondent's demography and ICT need of all aspects (Martilla and James, 1977; Ott and Longnecker, 2010).

RESULT AND DISCUSSION

Both primary and secondary data are then analyzed by descriptive analysis method, Importance Performance Analysis method, and hypothetical test. The results are presented

in Table 5. Table 6 presents hypothesis test between respondent demography characteristic and respondent satisfactory of ICT implemented in the bus terminal, whereas Table 7 presents hypothesis test between respondent demography characteristic and respondent necessity of ICT implemented in the bus terminal.

Table 5 Satisfactory Rate and Necessity Rate of ICT Implementation Based on Demography Characteristic of Respondents for Each Aspect at Pulo Gebang Terminal Jakarta, Indonesia

Characteristic	Satisfactory rate (S) and Necessity rate (N)																									
	1		2		3		4		5		6		7		8		9		10		11		12		13	
	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N
Gender																										
Male	2.87	3.82	2.83	4.01	2.88	3.95	2.93	3.77	3.33	4.04	3.01	3.99	2.60	4.00	2.14	3.45	3.25	4.10	2.92	4.25	2.98	3.84	2.19	4.34	2.83	4.02
Female	2.76	4.12	2.94	4.12	2.76	3.82	2.82	3.47	3.35	4.35	2.88	4.12	2.41	4.29	2.59	3.59	3.53	4.29	3.12	4.24	3.18	4.06	2.82	4.65	3.65	4.29
Age																										
< 25 years old	3.06	3.74	2.97	4.03	3.00	3.93	2.90	3.58	3.61	4.06	3.00	3.94	2.84	4.16	2.52	3.55	3.58	4.23	3.52	4.42	3.48	4.10	2.42	4.55	3.10	4.23
26-35 years old	3.04	4.07	2.78	3.85	2.85	4.04	3.22	3.63	3.48	4.15	3.15	4.30	2.81	4.22	2.26	3.48	3.41	4.19	3.07	3.96	3.19	3.89	2.37	4.19	3.30	3.96
36-45 years old	2.53	3.65	2.35	4.00	2.76	4.00	2.71	3.65	3.18	3.94	2.82	3.71	2.18	3.59	1.53	3.41	2.82	4.06	2.47	4.24	2.24	3.82	1.82	4.24	2.35	3.88
46-55 years old	2.50	3.83	3.17	4.22	2.78	3.56	2.72	4.17	2.94	4.11	2.83	3.89	2.17	4.06	2.28	3.22	3.22	4.06	2.39	4.39	2.89	3.56	2.50	4.50	3.22	4.00
> 55 years old	2.86	4.29	3.00	4.29	2.71	4.29	2.71	3.71	2.86	4.29	3.14	4.29	2.43	4.00	2.29	3.86	3.00	3.86	2.57	4.29	2.43	3.86	2.14	4.57	2.00	4.43
Education																										
< high school	2.93	3.67	3.33	4.04	3.37	4.00	2.96	3.41	3.15	3.74	2.81	3.44	2.48	3.78	2.26	3.22	3.30	3.59	2.74	4.26	3.04	3.48	2.67	4.30	3.30	3.70
High school	3.08	3.87	2.82	3.76	2.84	3.47	2.84	3.47	3.61	4.21	3.05	4.18	2.89	3.97	2.47	3.29	3.37	4.26	3.29	4.05	3.26	3.89	2.34	4.42	3.03	4.13
Higher education	2.58	4.32	2.48	4.38	2.51	4.45	2.86	4.29	3.01	4.41	3.02	4.35	2.22	4.46	1.89	3.94	3.02	4.51	2.71	4.61	2.62	4.19	1.93	4.43	2.69	4.29
Salary (Rp)																										
< 1,000,000	3.27	4.45	2.91	4,36	2.91	4.36	3.09	4.09	3.73	4.64	3.55	4.82	3.18	4.82	2.45	3.73	3.55	3.91	3.36	4.82	3.00	4.09	2.18	4.82	3.09	4.73
1,000,000-2,500,000	2.96	3.48	2.96	3,96	2.64	3.64	2.92	3.68	3.36	3.92	2.88	3.96	2.68	3.96	2.22	3.40	3.72	4.24	3.04	4.20	3.16	3.80	2.96	4.36	3.24	3.96
2,500,000-5,000,000	2.88	3.71	3.00	3.98	3.20	3.80	2.88	3.41	3.22	3.85	2.95	3.59	2.66	3.78	2.34	3.15	2.98	4.00	2.93	4.05	3.07	3.85	2.10	4.37	2.95	3.90
5,000,000-10,000,000	2.65	4.47	2.29	3.88	2.35	4.18	2.71	4.12	3.47	4.47	2.94	4.53	2.18	4.35	1.88	3.94	3.29	4.35	2.59	4.35	3.12	3.76	2.00	4.34	3.00	4.06
>10,000,000	2.00	3.83	2.83	4.50	2.83	4.50	3.33	4.17	2.83	4.33	2.83	4.17	1.50	4.00	2.00	4.17	3.33	4.33	3.00	4.50	1.67	4.33	2.00	4.33	1.67	4.50
Frequency of using bus per week																										
First time	3.15	3.73	2.88	3.77	2.96	3.50	2.85	3.46	3.42	4.04	3.00	4.04	2.73	4.19	2.04	3.62	3.38	4.38	2.92	4.54	3.12	4.00	2.73	4.65	3.08	4.25
2-6 times	2.59	3.69	2.83	4.10	3.14	4.00	2.83	3.66	3.17	3.90	2.62	3.48	2.31	3.72	2.41	3.19	3.03	3.83	2.90	4.14	3.00	3.52	2.28	4.07	3.21	3.69
7-11 times	2.80	4.00	2.70	4.10	2.40	3.70	3.00	4.10	3.50	4.10	2.90	4.40	2.60	3.90	2.30	3.70	3.50	4.10	3.10	4.20	3.30	3.80	2.20	4.20	2.50	4.20
12-16 times	2.67	4.17	2.17	3.83	2.17	4.00	2.67	3.67	3.17	4.67	3.17	4.67	2.50	4.33	2.50	3.67	3.17	3.83	3.17	4.17	3.00	4.00	2.83	4.83	3.00	4.33
>16 times	2.90	4.07	3.03	4.21	2.79	4.31	3.07	3.90	3.38	4.21	3.34	4.24	2.69	4.24	2.10	3.52	3.45	4.28	2.93	4.14	2.83	4.13	1.86	4.45	2.79	4.10
Reason of using bus																										
Have no vehicle	2.56	3.81	2.38	3.63	2.63	3.56	2.31	3.44	3.13	3.75	2.94	3.88	2.31	4.00	1.75	2.81	2.94	4.13	3.06	4.13	2.75	3.75	1.88	4.63	3.06	3.81
Cheaper	2.64	3.91	2.86	4.27	2.68	3.73	2.27	3.86	2.91	4.23	2.50	4.18	1.82	4.23	1.77	3.14	2.91	3.91	2.45	4.27	2.82	3.86	1.95	4.23	3.00	4.27
More secure	2.25	3.75	2.50	4.00	2.25	4.50	2.75	3.25	3.25	3.63	2.75	4.13	2.38	4.00	1.75	3.38	3.50	4.38	3.13	4.25	3.13	3.75	2.38	3.88	2.50	3.63
More convenience	3.25	3.93	3.36	4.06	3.44	4.03	3.47	3.78	3.58	4.06	3.39	3.78	3.03	3.92	2.78	3.61	3.56	3.92	3.11	4.11	3.06	3.69	2,64	4.47	3.17	3.97
Other	2.83	3.78	2.39	4.06	2.67	4.06	3.17	3.89	3.56	4.50	2.94	4.33	2.89	4.17	2.28	4.22	3.50	4.72	3.06	4.61	3.33	4.44	2.39	4.44	2.67	4.44

Legend: 1, 2, ..., 13 = number of variable of ICT implementation aspects

Table 6 Hypothesis Test Between Respondent Demography Characteristic and Respondent Satisfactory of ICT Implemented at Pulo Gebang Terminal Jakarta, Indonesia

Characteristic of respondents	Gender	Age	Education	Salary (Rp)	Frequency of using bus per week	Reason of using bus
Value of t	1.234	-2.974	-0.681	-0.594	-0.494	1.770
Result	Accept H_0	Accept H_0	Accept H_0	Accept H_0	Accept H_0	Reject H_0

Legend: 1, 2, ..., 13 = number of variable of ICT implementation aspects

Rank Spearman correlation(r_s) $r_s = \dfrac{\sum X^2 + \sum Y^2 - \sum d_i^2}{2\sqrt{\sum X^2 \sum Y^2}}$

with: X = respondent demography rank

Y = variable of ICT implementation aspects rank

d_i = difference between X and Y

H_0: there is no relationship between respondent demography characteristic and respondent satisfactory of ICT implemented

H_a: there is relationship between respondent demography characteristic and respondent satisfactory of ICT implemented

$t = r_s \sqrt{\dfrac{n-2}{1-r_s^2}}$ with n = sample size

α =10% t_{table} = 1.660

Accept H_0 if $t \leq t_{table}$

Table 7 Hypothesis Test Between Respondent Demography Characteristic and Respondent Necessity of ICT Implemented at Pulo Gebang Terminal Jakarta, Indonesia

Characteristic of respondents	Gender	Age	Education	Salary (Rp)	Frequency of using bus per week	Reason of using bus
Value of t	1.770	-0.867	3.626	0.396	0.297	2.105
Result	Reject H_0	Accept H_0	Reject H_0	Accept H_0	Accept H_0	Reject H_0

Legend: 1, 2, ..., 13 = number of variable of ICT implementation aspects

Rank Spearman correlation(r_s) $r_s = \frac{\sum X^2 + \sum Y^2 - \sum d_i^2}{2\sqrt{\sum X^2 \sum Y^2}}$

with: X = respondent demography rank

Y = variable of ICT implementation aspects rank

d_i = difference between X and Y

H_0: there is no relationship between respondent demography characteristic and respondent necessity of ICT implemented

H_a: there is relationship between respondent demography characteristic and respondent necessity of ICT implemented

$t = r_s\sqrt{\frac{n-2}{1-r_s^2}}$ with n = sample size

α =10% t_{table} = 1.660

Accept H_o if $t \leq t_{table}$

Another result is the average value of satisfactory rate and the average value of necessity rate of ICT implementation at Pulo Gebang terminal Jakarta, This result is given in Table 8 and Figure 2.

Table 8 Average Value of Satisfactory Rate and Necessity Rate of ICT Implementation at Pulo Gebang Terminal Jakarta, Indonesia

Characteristic of respondents	Satisfactory rate (S) and Necessity rate (N)																									
	1		2		3		4		5		6		7		8		9		10		11		12		13	
	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N
Average value	2.85	3.87	2.85	4.03	2.86	3.93	2.91	3.72	3.33	4.09	2.99	4.01	2.57	4.05	2.22	3.47	3.33	4.13	2.35	4.22	2.45	4.25	3.01	3.88	2.97	4.00

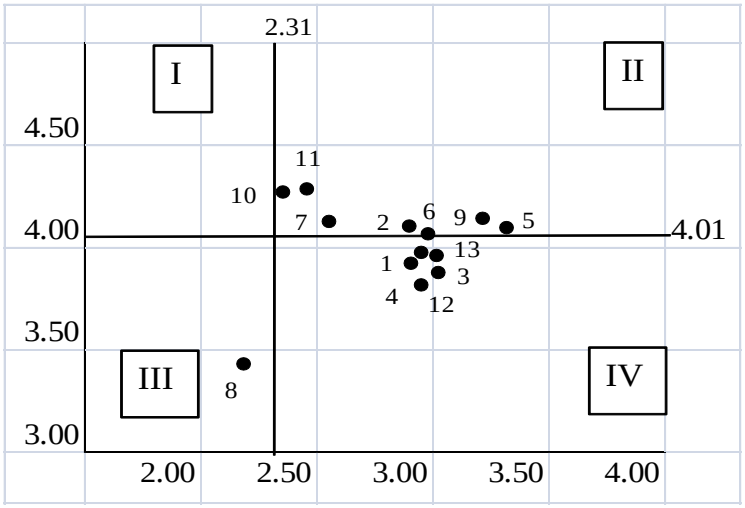

Figure 2 Importance Performance Analysis of Satisfactory Rate and Necessity Rate of ICT Implementation at Pulo Gebang Terminal Jakarta, Indonesia

It can be seen in Table 5 that, in general, satisfactory rate of existing ICT implementation at the terminal is lower than necessity rate of existing ICT implementation, meaning that existing ICT implementation does not fulfill the passenger's need. Table 6 shows that the only significant relationship is found between respondent with reason of using bus as public transportation and respondent satisfactory of ICT implemented. There is no significant relationship between other respondent demography characteristics (gender, age, education, salary, and frequency of using bus per week) and respondent satisfactory of ICT implemented.

Table 7 shows that relationship is significant between respondent with gender, education, and reason of using bus and respondent necessity of ICT implemented at the terminal. There is no significant relationship between other respondent demography characteristics (age, salary, and frequency of using bus per week) and respondent necessity of ICT implemented. The results presented in Table 8 and Figure 2 indicate that variables with high satisfactory and high necessity (category II, to be maintained) are number 5-easiness to book bus ticket by website/online, number 9-availability about self-ticketing in the terminal, number-6 availability about service information by operator, number 2-easiness to have bus schedule information in the terminal, number 7-availability about bus delay information, number 11-availability about real time bus location on board in the terminal, and number 10-availability about real time bus information (route, schedule, ticket price, delay time) on board in the terminal. Variables with high satisfactory and low necessity (category IV, to be improved) are number 13-facility about security complain service, number 3-easiness to have online bus information (route, schedule, ticket price), number 12-availability about Wi-Fi or hot spot in the terminal, number 4-easiness to book online bus ticket, and number 1-easiness to have bus route information in the terminal. The variable with low satisfactory and low necessity (category III, to be improved soon) is number 8-availability about terminal layout information.

CONCLUSION

ICT implementation at an integrated bus terminal, as a part of public infrastructure, is crucial. Unfortunately, the current implementation in the bus terminal has not yet fulfilled the respondent's need. The results of this study indicated that the existing ICT implementation in the integrated bus terminal needs to be improved, particularly those related to the easiness of booking bus ticket online and availability of self-ticketing facilities in the terminal.

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