PRIORITY OF ICT IMPLEMENTATION AT THE LARGEST BUS TERMINAL IN BANDUNG INDONESIA

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ABSTRACT

Bus terminal is the important facilityto encourage society to use bus as one of public transportations that can reduce traffic congestion especially in large cities in developing country like Indonesia. Nowadays, in order to improve service quality to the bus passenger, implementation of Information, Communication, and Technology (ICT) is crucial. The aim of this study is to determine and provide recommendation regarding priority of ICT implementation at the largest bus terminal in large city in Indonesia. Case study is at Leuwipanjang Bus Terminal, the largest bus terminal in Bandung, Indonesia. Bus terminal authority officer and 461 passengers as respondents involved in this study. Using Quadrant Analysis, all respondents answer indicated that priority ICT implementation to be applied soon can be divided into two kinds of information i.e. online ICT information including bus timetable and complain facility, and fixed information in the terminal including wheelchair and prayer room locations.

Keywords: ICT implementation; service quality; largest bus terminal; Bandung; Indonesia.

A. INTRODUCTION

Bus is one of public transportation modes needed by society in many large cities. During operation, bus needs bus terminal as a facility where bus passenger comes and goes. Terminal has to be a place that fulfill a number of aspects to serve bus passenger including safety, security, convenience, and inform-able (Narboneta, Chelcie and Teknomo, Kardi, 2016, O'Flaherty,C.A., 2003; Grava, 2002). Therefore, ICT implementation is compulsory. In Indonesia, there are regulations regarding minimum service standard of bus terminal that have to be fulfilled.

Nevertheless, not all of ICT minimum service standard have been implemented at the bus terminal. Therefore, it has to be evaluated and then implemented by priority needed. The aim of this study is to determine and provide recommendation regarding priority of ICT implementation at the largest bus terminal in large city in Indonesia. Case study is at Leuwipanjang Bus Terminal, the largest bus terminal in Bandung, Indonesia.

B. LITERATURE STUDY

Bus terminal provides facilities for passengers to choose the bus to specific destination and to change from one public transportation mode to another. Bus terminal authority manages bus operation and maintenance, staff working schedule, and ticket transaction in order to minimize time delay (Javid,
Muhammad Ashraf, Okamura, Toshiyuki, andNakamura Fumihiko, 2015, O'Flaherty,C.A., 2003; Grava, 2002).

1. Bus Terminal in Indonesia

Regulation of Ministry of Transportation Republic of Indonesia number 43 year 2016 said that terminal is the place used as public transportation vehicle base to manage public transportation timetable and the place for people and goods to change from one transportation mode to another. Furthermore, there are three types of passenger transport terminal i.e. Type A, Type B, and Type C. Type A passenger transport terminal serves public transportation between countries, between cities in the province and between provinces, in the city, and in the village. Type B passenger transport terminal serves public transportation between cities in the province, in the city, and in the village, whereas type C passenger transport terminal serves public transportation in the city, and in the village (Ministry of Transportation Republic of Indonesia, 2015).

Furthermore, it has to be complemented by main facilities, support facilities, and public facilities, including ICT facilities inside the terminal and using internet facility (Ministry of Transportation Republic of Indonesia, 2015). Availability and implementation of ICT in the terminal has to be responsive to the customers/

passengers (Wright, Lloyd, 2002), for example bus fare payment service. Bus fare payment service that usually used are bus fare payment in the bus, bus fare payment using Near Field Communication (NFC), and bus fare payment using simple bus ticket card. Moreover, passenger transport terminal has to fulfill safety, security, convenience, access ability, equality, and regulation as minimal service standard requirements (Ministry of Transportation Republic of Indonesia, 2012).

2. Leuwipanjang Bus Terminal in Bandung Indonesia

Leuwipanjang Bus Terminal is the largest bus terminal in Bandung, West Java province, Indonesia, and included in type A terminal. This terminal operates since 1996 with land area of 4.5 hectares and can accommodates 100 busses in static condition and can accommodate 500-600 busses per day in moving condition. Nowadays, it has 19 bus lanes to serves 23 bus routes to all cities in and between provinces in Indonesia.

Based on existing condition at Leuwipanjang Bus Terminal in Bandung, Indonesia, there is limited number of implementation of Information, Communication, and Technology (ICT). The information provided to passenger in the terminal is using fixed message sign, for example bus route, bus timetable, and bus fare.

C. METHODOLOGY

Steps of research methodology in order to determine and provide recommendation regarding action program of ICT implementation at the largest bus terminal in large city in Indonesia is presented in Figure 1.1. Regular, consistent and continuous evaluation and audit action by the bus terminal authority is important to maintain a good ICT service to the passengers.

D. RESULTS AND DISCUSSION
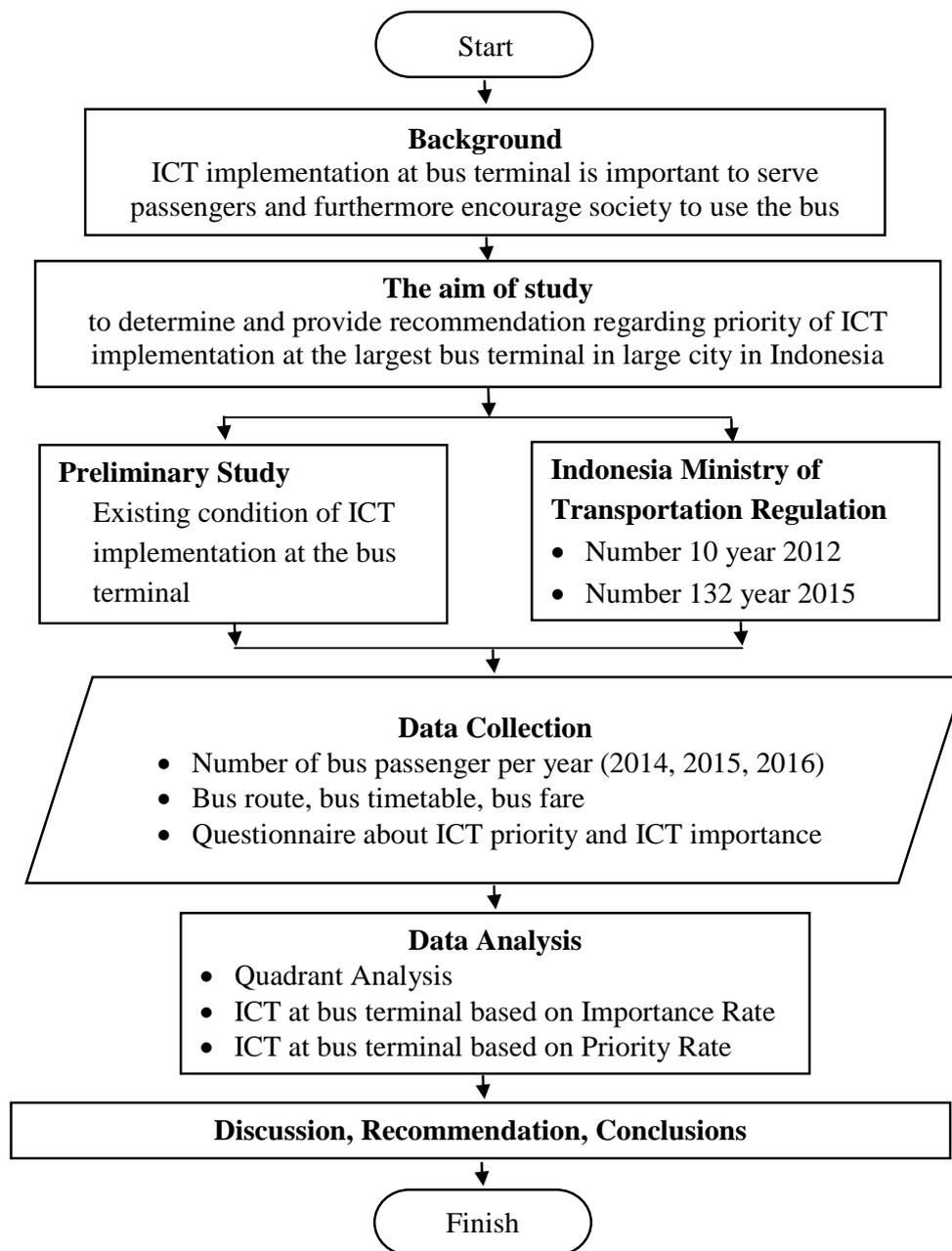
1. Data and Analysis

Primary data and secondary data used in this study and collected in May 2017 and June 2017. Primary data is passenger's answer as research respondent of questionnaire and ICT availability in Leuwipanjang bus terminal in Bandung, Indonesia, whereas secondary data including bus route, bus timetable, bus fare. Bus timetable and bus fare information at Leuwipanjang bus terminal is presented in Figure 1.2.

Data regarding number of bus and bus passengers at Leuwipanjang bus terminal in Bandung, Indonesia is presented in Table 1.1. In order to find out the importance rate and the priority rate of ICT indicators at the bus terminal, 461 passengers as respondent sample are involved in this study (Ott, R. Lyman, Longnecker, Michael T., 2010). This number is larger than the minimum sample size = 400 person with α = 5%. In more detail, data regarding all respondents is presented in Table 1.2.

Furthermore, based on minimum service standard of ministry of transportation, Republic of Indonesia number 132 year 2015 regarding ICT implementation in the terminal, ICT indicator and ICT availability in Leuwipanjang Bus Terminal in Bandung, Indonesia is presented in Table 1.3. Moreover, based on answers of 461 respondents, average value of priority rate and importance rate of ICT availability at Leuwipanjang bus terminal in Bandung Indonesia is presented in Table 1.4. The value range is between 1 up to 5.

Quadrant Analysis (Martilla, John A. and James, John C., 1977)used to find out relationship and then to determine which performance indicators and which importance indicators that has fulfilled the respondents satisfaction. But, because implementation of ICT at Leuwipanjang bus terminal is limited, performance rate of ICT implementation cannot be asked to the bus passengers.

Therefore, in this study, Quadrant Analysis used to find out relationship and then to determine which priority indicators and which importance indicators that has to be implemented first based on respondent's answers in the ICT priority and importance questionairre. Figure 1.3 presents the Quadrant Analysis between importance rate and priority rate of ICT implementation at Leuiwipanjang bus terminal.

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│                    Background                          │
│  ICT implementation at bus terminal is important to    │
│  serve passengers and furthermore encourage society    │
│  to use the bus                                        │
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│                 The aim of study                       │
│  to determine and provide recommendation regarding     │
│  priority of ICT implementation at the largest bus     │
│  terminal in large city in Indonesia                   │
└────────┬──────────────────────────────┬────────────────┘
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┌──────────────────┐        ┌──────────────────────────┐
│ Preliminary Study│        │ Indonesia Ministry of     │
│                  │        │ Transportation Regulation │
│ Existing         │        │ • Number 10 year 2012     │
│ condition of ICT │        │ • Number 132 year 2015    │
│ implementation   │        │                           │
│ at the bus       │        │                           │
│ terminal         │        │                           │
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      /          Data Collection                  /
     / • Number of bus passenger per year        /
    /    (2014, 2015, 2016)                      /
   /  • Bus route, bus timetable, bus fare       /
  /   • Questionnaire about ICT priority and     /
 /      ICT importance                          /
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│              Data Analysis               │
│  • Quadrant Analysis                     │
│  • ICT at bus terminal based on          │
│    Importance Rate                       │
│  • ICT at bus terminal based on          │
│    Priority Rate                         │
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Figure 1. Steps of Research Framework to Provide Recommendation Regarding Priority of ICT Implementation at The Largest Bus Terminal In Large City In Indonesia

Figure 2 Bus Timetable And Bus Fare Information At Leuwipanjang Bus Terminal In Bandung, Indonesia

Tabel 1. Number of Bus and Number of Bus Passengers at Leuwipanjang Bus terminal in Bandung, Indonesia

Year	Arrival		Departure	
	Bus (vehicle)	Passenger (person)	Bus (vehicle)	Passenger (person)
2014	211,846	2,303,039	214,106	4,255,351
2015	209,761	2,100,465	211,787	3,677,503
2016	210,645	2,085,061	215,303	3,279,782
Slovin equation (Ott, R. Lyman, Longnecker, Michael T. 2010) $n = \dfrac{N}{1 + N(e)^2}$		with: n = sample size N = population size e = error rate (%)		
Minimum sample with $e = 5\%$		400 person		
Sample used in the study		461 person		

Tabel 2. Characteristics of Respondents

No.	Characteristic	Number of Person	Persentage
1	Gender		
	Male	249	54%
	Female	212	46%
2	Age (year)		
	10-20	53	12%
	21-30	314	68%
	31-40	58	13%
	41-50	28	6%
	> 50	8	1%
3	Occupation		
	Scholar	275	60%
	Employee	148	32%
	Enterpreneur	17	4%
	No job	21	4%
4	Education		
	Bachelor	227	49%
	High School	225	49%
	Secondary School	9	2%
	Primary School	0	0%
5	Frequency/ week of using bus at the terminal		
	1	131	28%
	2	27	6%
	3	67	15%
	4	128	28%
	5	108	23%

Tabel 3. ICT Indicator and ICT Availabilityat Leuwipanjang Bus Terminal in Bandung Indonesia

No	ICT Indicator	Availability	
		Yes	No
1	Bus route in the terminal	√	
2	Bus route in the internet	√	
3	Bus timetable in the terminal	√	
4	Bus timetable in the internet	√	
5	Bus departure time using loudspeaker		√
6	Bus fare in the terminal	√	
7	Bus fare in the internet	√	
8	Bus route network in the terminal	√	
9	Bus route network in the internet		√
10	Route origin destination in the terminal	√	
11	Route origin destination in the internet	√	
12	Barrier to guide people during buying bus ticket		√
13	Bus ticket counter	√	
14	Payment using Near Field Communication (NFC)		√
15	Payment using smart card		√
16	Payment using coin		√
17	Proof of payment verification		√
18	Security complaint facility using office phone number or SMS	√	
19	Road marking for bus	√	
20	Location and way to use safety equipment		√
21	Emergency complaint facility using office phone number or SMS	√	
22	CCTV location		√
23	Sign regarding rest room	√	
24	Sign regarding prayer room	√	
25	Access way for wheelchair and disable person		√
26	Seat location for wheelchair, disable person, senior, and pregnant women	√	
27	Rest room location for wheelchair, disable person, senior, and pregnant women	√	

Tabel 4. Average Value of Priority Rate and Importance Rate of ICT Availability at Leuwipanjang Bus Terminal in Bandung Indonesia

Ranking	Variabel	ICT Indicator	Average Value	
			Priority Rate	Importance Rate
1	no 22	CCTV location	4.54	4.47
2	no 26	Seat location for wheelchair, disable person, senior, and pregnant women	4.52	4.44
3	no 27	Rest room location for wheelchair, disable person, senior, and pregnant women	4.50	4.43
4	no 25	Access way for wheelchair and disable person	4.47	4.41
5	no 21	Emergency complaint facility using office phone number or SMS	4.36	4.30
6	no 13	Bus ticket counter	4.34	4.24
7	no 7	Bus fare in the internet	4.33	4.26
8	no 18	Security complaint facility using office phone number or SMS	4.32	4.27
9	no 20	Location and way to use safety equipment	4.29	4.22
10	no 4	Bus timetable in the internet	4.28	4.25
11	no 23	Sign regarding rest room	4.28	4.22
12	no 2	Bus route in the internet	4.26	4.18
13	no 24	Sign regarding prayer room	4.24	4.21
14	no 5	Bus departure time using loudspeaker	4.24	4.25
15	no 3	Bus timetable in the terminal	4.23	4.12
16	no 6	Bus fare in the terminal	4.21	4.12
17	no 9	Bus route network in the internet	4.20	4.11
18	no 11	Route origin destination in the internet	4.17	4.14
19	no 1	Bus route in the terminal	4.12	4.01
20	no 19	Road marking for bus	4.11	4.10
21	no 10	Route origin destination in the terminal	4.10	4.09
22	no 8	Bus route network in the terminal	4.08	4.00
23	no 17	Proof of payment verification	4.04	3.99
24	no 12	Barrier to guide people during buying bus ticket	4.04	4.03
25	no 15	Payment using smart card	4.00	3.93
26	no 16	Payment using coin	3.13	3.27
27	no 14	Payment using Near Field Communication (NFC)	2.84	3.02
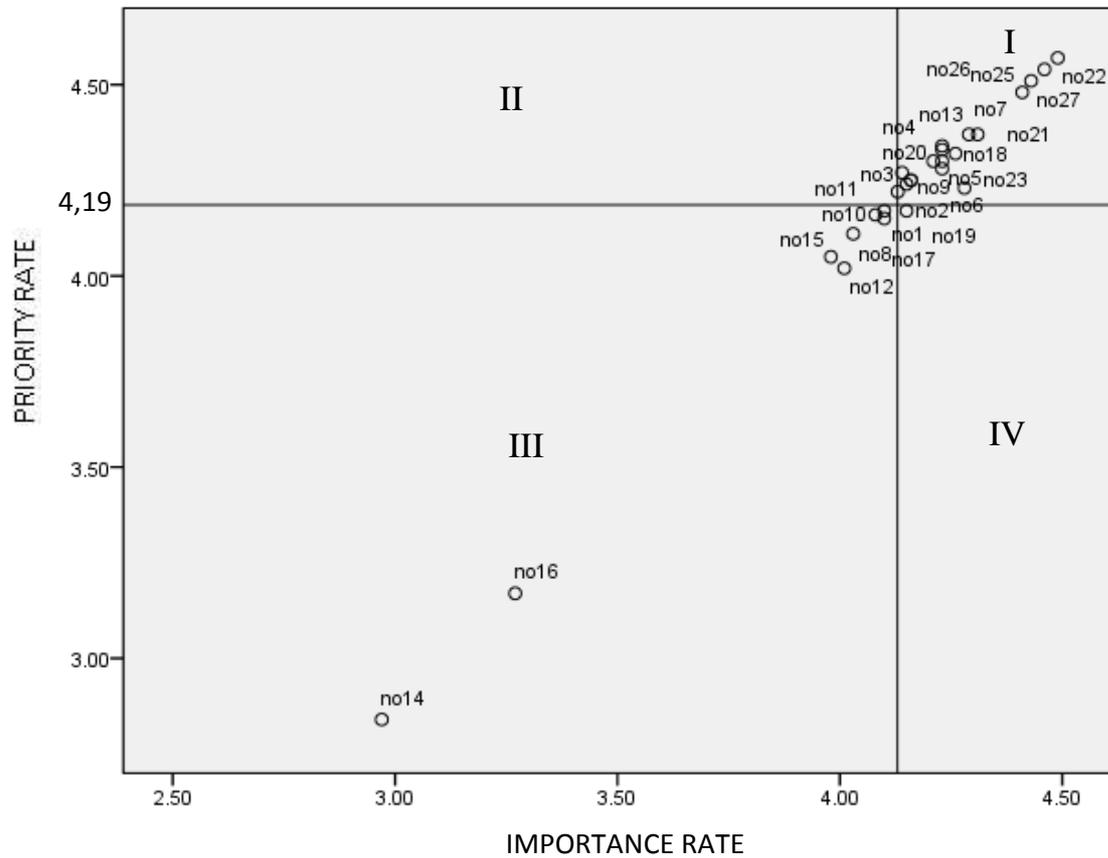
Figure 3. Quadrant Analysis between importance rate and priority rate of ICT implementation at Leuiwipanjang bus terminal in Bandung, Indonesia

2. Ressult and Discussion

Data in Table 1.1shows that at Leuwipanjang bus terminal as largest bus terminal type A in Bandung, Indonesia, there are high number of passengers and busses arrive and depart every year. Therefore, in order to manage bus schedule and operation and enhance service quality to the passengers, ICT implementation is important. More detal regarding passenger's characteristics as presented in Table 1.2,number of male and female bus passengers is almost the same, most passengers are adults with the age between 21-30 years old (68%). Most passengers are scholar (60%) and employee (32%), have high school (49%) and bachelor education degree (49%), and usually have trip by bus 2 times or more than 2 times per week (72%). Based on bus passenger's characteristics as the research respondets, it can be said that the respondent is not only fulfilled number of passengers (461 person) involed but also have similar number of respondent gender, enough education level, frequency of using bus per week, to uderstand the questions in the questionairre.

From Table 1.3, it can be seen that based on minimum service standard of ministry of transportation, Republic of Indonesia number 132 year 2015 regarding ICT implementation in the terminal, from 27 ICT indicators,17 ICT indicators available in Leuwipanjang Bus Terminal in Bandung, Indonesia. Nevertheles, not all of information available in the terminal is available online in internet as well. Moreover, the information is still not using technology, for example bus ticket counter, sign regarding: bus route network, rest room, prayer room, and seat location for disable person, that still use paper or board.

Table 1.4 shows that 25 out of 27 average value of priority rate of ICT availability at Leuwipanjang bus terminal in Bandung, Indonesia is ≥ 4.00 (out of 5.00) except payment using coin and payment using Near Field Communication (NFC). Whereas, 24 out of 27 average value of importance rate of ICT availability is ≥ 4.00 (out of 5.00) except payment using smart card, payment using coin, and payment using Near Field Communication (NFC). These condition means that most of ICT

information at the terminal based on minimum service standard is important and have priority to implement by terminal authority.

Based on passenger's characteristic in Table 1.2, ICT minimum service standards in bus terminal in Table 1.3, and average value of priority rate and importance rate of ICT availability at the terminal in Table 1.4, then priority of ICT implementation in the bus terminal based on passenger's characteristic is presented in Table 1.5.

Tabel 5. Priority of ICT implementation in Leuwipanjang bus terminal
based on passenger's characteristic

Highest Persentage of Respondent Characteristic	Indicators	
	Priority (Average Value)	Importance (Average Value)
Male (54%)	Seat location for wheelchair, disable person, senior, and pregnant women (4.53)	CCTV location (4.49)
Female (46%)	Seat location for wheelchair, disable person, senior, and pregnant women (4.51)	CCTV location (4.43)
Age 21-30 years old (68%)	Seat location for wheelchair, disable person, senior, and pregnant women (4.65)	Seat location for wheelchair, disable person, senior, and pregnant women (4.33)
Occupation: scholar (60%) employee (32%)	Seat location for wheelchair, disable person, senior, and pregnant women (4.61) Sign regarding rest room (4.57)	Seat location for wheelchair, disable person, senior, and pregnant women (4.51) CCTV location (4.51)
Education: high school (49%) bachelor education degree (49%)	Sign regarding rest room (4.63) Access way for wheelchair and disable person (4.71)	Sign regarding rest room (4.43) CCTV location (4.55)
Frequency of using bus: ≥ 2 times per week (72%)	Seat location for wheelchair, disable person, senior, and pregnant women (4.74) CCTV location (4.63)	Seat location for wheelchair, disable person, senior, and pregnant women (4.70) CCTV location (4.63)

It can be seen in Table 1.4 and Table 1.5 that the priority indicators and importance indicators of ICT implementation at the terminal based on average value of priority rate and importance rate of ICT availability and based on priority of ict implementation in leuwipanjang bus terminal based on passenger's characteristic are the same i.e. as follow:
- Seat location for wheelchair, disable person, senior, and pregnant women.
- CCTV location.
- Sign regarding rest room, especially for disable person.
- Access way for wheelchair and disable person.

Figure 1.3 shows 27 ICT indicators in 4 quadrants based on Quadrant Analysis. Detail explanatioan is as follow:
- Quadrant I contains16 ICT indicators with high Important Rate and high Priority Rate to implement. The indicators are bus route in the internet, bus timetable in the internet, bus departure time using loudspeaker, bus fare in the terminal, bus fare in the internet, bus ticket counter, payment using coin, security complaint facility using office phone number or SMS, location and way to use safety equipment, emergency complaint facility using office phone number or SMS, CCTV location, sign regarding rest room, sign regarding prayer room, access way for wheelchair and disable person, seat location for wheelchair, disable person, senior, and pregnant women, rest room location for wheelchair, disable person, senior, and pregnant women.
- Quadrant II contains1 ICT indicator with low Important Rate and high Priority Rate to implement. The indicator is bus route network in the internet.

- Quadrant III contains16 ICT indicators with low Important Rate and low Priority Rate to implement. The indicators are bus route in the terminal, bus timetable in the terminal, bus route network in the terminal, route origin destination in the terminal, barrier to guide people during buying bus ticket, payment using Near Field Communication (NFC), payment using smart card, proof of payment verification, road marking for bus.
- Quadrant IV contains1 ICT indicators with high Important Rate and low Priority Rate to implement. The indicator is route origin destination in the internet.

This result is used to provide recommendation regarding priority of ICT implementation at Leuwipanjang Bus Terminal in Bandung, Indonesia.

3. Recommendation

Based on result study and discussion presented earlier, recommendation regarding priority of ICT implementation at the largest bus terminal Leuwipanjang in Bandung Indonesia are presented in Figure 1.4. Priority of ICT implementation is considering the existing availability of ICT information at the terminal, minimal service standard to be fulfilled, and highest value of priority rate and important rate of ICT indicators.
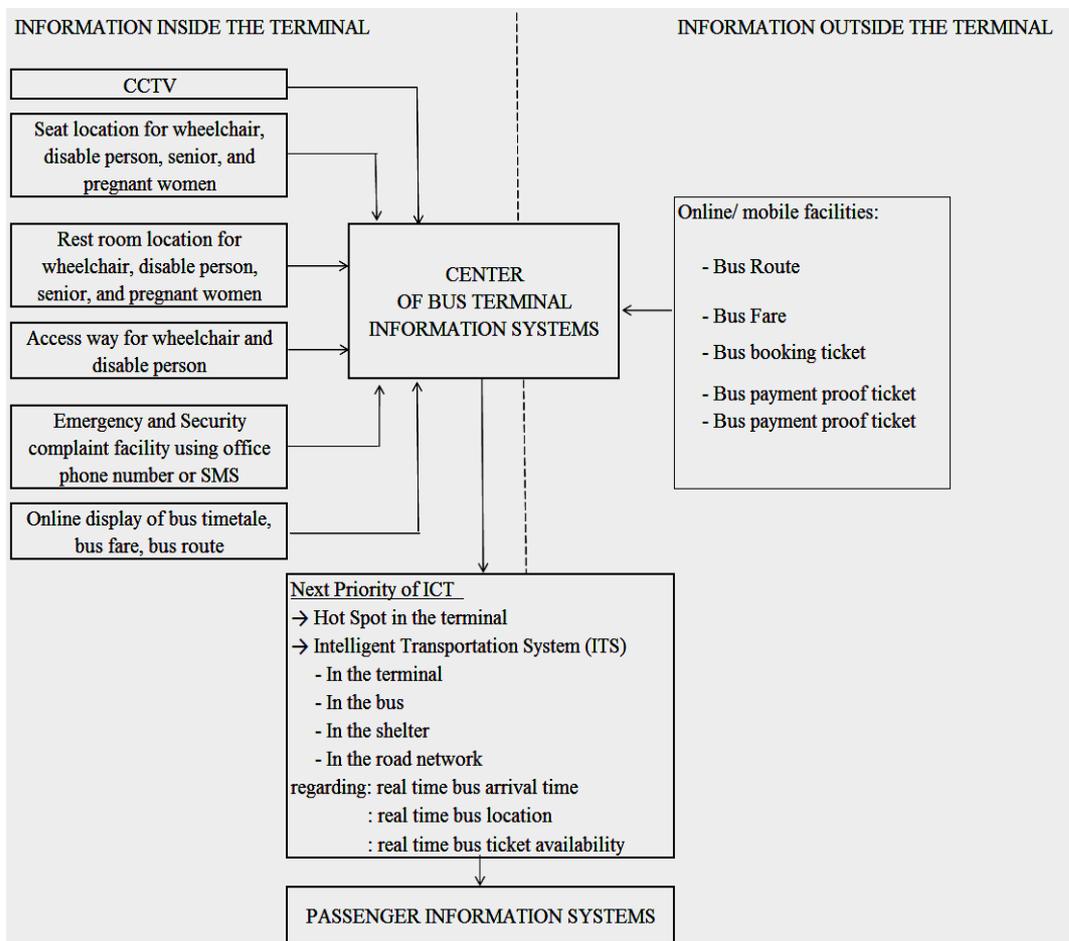
Figure 4. Recommendation of priority ICT implementation at the largest bus terminal Leuwipanjang in Bandung Indonesia

E. CONCLUSION

For large cities in developing country like Indonesia that usually experience traffic congestion day by day, this study is important. Detail results and recommendations provided regarding implementation of ICT with priority includingonline ICT in the bus terminal in order to improve service quality to the passenger have to be applied as soon as possible. The availability, implementation, and easy accessibility of ICT facilities in the bus terminal will encourage society to use bus as public transportation. In the future,

implementation of Intelligent Transportation Systems (ITS) in the terminal, in the bus, in the bus shelter, and in the road network have to be consiredered. This condition will lead to reduction of traffic congestion in the city and on the road between cities. Furthermore, in order to always serve the good ICT, it has to be evaluated and audited by the bus terminal authority regularly, consistently and continuously.

ACKNOWLEDGMENT

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