TUGAS AKHIR- TI 141501

MENGUKUR KESEDIAAN UNTUK MEMBAYAR (WILLINGNESS TO PAY) DAN KESIAPAN SURABAYA MASS RAPID TRANSIT(SMART), MONOREL DAN TREM: SEBUAH SURVEI

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Surabaya 2015

FINAL PROJECT- TI 141501

MEASURING READINESS AND WILLINGNESS TO PAY (WTP) OF SURABAYA MASS RAPID TRANSIT (SMART), MONORAIL AND TRAM: A SURVEY

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Surabaya 2015

APPROVAL SHEET

MEASURING READINESS AND WILLINGNESS TO PAY (WTP) OF SURABAYA MASS RAPID TRANSIT (SMART), MONORAIL AND TRAM: A SURVEY

FINAL PROJECT

Submitted to Acquire the Requirement of Bachelor Degree:
Department of Industrial Engineering
Faculty of Industrial Technology
Institut Teknologi Sepuluh Nopember
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SURABAYA, 13 JULY 2015

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ABSTRAK

Mass Rapid Transit (MRT) adalah alternatif pilihan yang popular untuk transportasi umum di kota besar. Hal tersebut dipercaya dapat meningkatkan kualitas layanan hidup dengan mengurangi tingkat kemacetan, polusi, dan konsumsi BBM pada kendaraan pribadi. Pemahaman masyarakat mengenai mode transportasi baru "SMART" yang akan dibangun di kota Surabaya , Indonesia, beberapa penelitian dilakukan. Penelitian ini menyajikan kesedian masyarakat, kesediaan untuk berpindah, dan kesediaan untuk membayar yang ditujukan pada monorel dan trem. Konsep kesiapan diambil berdasarkan kebiasaan pro-lingkungan. Beberapa motif yang ditawarkan pada kesediaan untuk berpindah. Kesediaan untuk membayar focus pada dua jenis, opsi dan harga. Random Utility Model diperkenalkan untuk mengukur dan menganalisa tiga opsi dari desain SMART. Model dikalibrasikan dari data yang dikumpulkan dari kuesioner di mana calon pengguna memberikan pilihan dari beberapa alternatif untuk merepresentasikan motif kesediaan dan layanan MRT monorel dan trem yang akan diimplementasikan. Sebuah survei langsung dilakukan sejumlah 384 responden yang merepresentasikan 31 kecematan di kota Surabaya.

Hasil penelitian menunjukkan sebagian besar menyatakan siap menggunakan monorel dan trem, dengan level tertinggi faktor dampak lingkungan. Beberapa motif kesediaan untuk berpindah menunjukkan kualitas layanan yang terpilih yaitu jarak stasiun, tarif parkir, dan antar kedatangan bus feeder yang rendah. Kalibrasi tiga opsi kesediaan untuk membayar menujukkan Opsi 1 terpilih untuk trem dan Opsi 2 atau Opsi 3 terpilih untuk monorel. Selanjutnya untuk atribut yang terpilih, kesediaan berdasarkan harga ditunjukkan pada rentang 10000 hingga 12500 IDR dengan mempertimbangkan spesifikasi MRT.

Kata Kunci:*: Transportatsi umum, Random Utility Model, Kesiapan, SMART, Kesediaan untuk berpindah, Kesediaan untuk membayar.*

MEASURING READINESS AND WILLINGNESS TO PAY (WTP) OF SURABAYA MASS RAPID TRANSIT (SMART), MONORAIL AND TRAM: A SURVEY

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ABSTRACT

Mass Rapid Transit (MRT) is popular options selected for transportation publics in the big city. It is believed that can improve service life quality by reducing congestion, transportation pollutants, and fuel consumption for private vehicles. The social understanding of new transportation mode "SMART" that will be built in Surabaya City, Indonesia, several studies were conducted. This study presents social readiness, willingness to shift (WTS), and willingness to pay (WTP) that consists of Monorail and Tram. The adopted readiness is built on the pro-environmental attitude behavior. Along several motives are offered into WTS. WTP concerns into two models, option and price. Random Utility Model (RUM) is introduced to measure and to analyze three options of SMART designs. The model is calibrated by using the collected data from questionnaire in which user makes choice among alternatives choice representing willingness motives and MRT service for monorail and tram that will be implemented. A direct survey was collected to 384 respondents representing the 31 regions in Surabaya City.

The results indicate the majority are ready to use monorail and tram, with high level for environmental impact. Several motives of WTS show the preferable service quality with small distance, cost, and inter-arrival choice. The calibration of three options WTP indicates Option 1 is the selected for tram and others for monorail whether Option 2 and Option 3. Furthermore, for the chosen attributes, the willingness price is range 10000 IDR up to 125000 IDR considered by MRT specification.

Key word: Public transportation, Random utility model, Readiness, SMART, Willingness to shift, Willingness to pay.

PREFACE

All praises due to Allah because of all His mercy and charities, the author able to complete this final project, "Measuring Readiness and Willingness to Pay (WTP) of Surabaya Mass Rapid Transit (SMART), Monorail and Tram: A Survey".

Final project is composed to acquire the requirement of Bachelor Degree in Industrial Engineering Department, Faculty of Industrial Technology, Institut Teknologi Sepuluh November Surabaya. During execution process of final project, a lot of assistance, constructive suggestions, and motivational have been received from several stakeholders. For all the advice and motivation, the author would like to thank to:

1. Prof. Iwan Vanany, ST., MT., Ph.D as the supervisor which had been checking and giving suggestion or revises during execution process of final project, the author able to complete this final project on schedule.
2. Prof Ir. I Nyoman Pujawan M.Eng., Ph.D and Dr. Erwin Widodo, S.T., M.Eng who support my final project by adding critics and suggestions to be better.
3. Prof. Ir. Budi Santosa, M.Sc, Ph.D., as Chairman of the Industrial Engineering Department of ITS.
4. Mr. Yudha Andrian as the Final Project Coordinator Industrial Engineering Department ITS.
5. All lecturers of Industrial Engineering Department ITS Surabaya for all knowledge were given during the author studied at ITS.
6. Both of parents and family who always provided the incredible support and motivation for the author.
7. BAPPEKO (Badan Perencanaan Pembangunan Kota) Surabaya that had supported and served data collection and validation during final project research.

8. Mr. Teguh, Mrs. Ni'matus, and all Administration staff of Industrial Engineering Department ITS that have helped the process of registration and administrative work practices writers.
9. Project partner, Ines, Feny, Rio, and Husni who support each other with happiness and grief in doing SMART Acceleration project until it have finished.
10. Survey Team, Dicki, Amir, Dini, Rizkyta, Nana, Riris, Dyah, Kanifah, Haris, Afrian, Fahmy, Hafizh, and Danim who help spreading the questionnaire during this final project is executed.
11. Surabaya society that had served a short time to fill and to answer the final project questionnaire exactly.
12. Final project family, Dhi Fadlin, Andy Makkaraseng, Elvi Armadani, and Muhammad Faizal Lihawa who give motivation and spirit each other to achieve Bachelor graduation 112 ITS.
13. Firza, Denisa, and Wike that become my sister in last four year and encourage each other by giving high motivation when I was studied Bachelor in Industrial Engineering.
14. VERESIS and Q-Class, because of encouraging each other, giving advice, the togetherness and cheerfulness during this final project properly and on time.

This final project report also did not escape from mistaken so the author apologizes profusely. Therefore, the author is willing to receive any feedback and constructive criticism from all sides for the better creation final project implementation. The author also hopes that this final project is beneficial to the research object and Industrial Engineering Department in conducting research and improvement.

Surabaya, 09 July 2015

Author

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CHAPTER 1
INTRODUCTION

This chapter explains about background, problem identification, objectives and benefits, experiment scope of doing thesis research which contains of limitations and assumptions, and thesis outline.

1.1 Background of Study

In public transportation, high service quality becomes one of important issues in some big city, especially urban areas. Public transportation mode is a facility provided to support the society mobility. The existence of public transportation cannot be denied its benefits, especially from the customer‟s loyalty in terms of cost efficiency (Eboli, L. and Mazulla, G., 2008). Commonly, public transportion is demanded to be affordable in term of price (Larson et al., 2014). It is an option based on the assumption of rationing or proportioning choice. The problem in Indonesia is lack of public transportation service which is safe, convenient, fast, and integrated, so people prefer to use their private transportation compared with public transportation. Consequently, numbers of private vehicle have been growing rapidly in Indonesia, particularly in Surabaya City as the object of this research. Increasing of private transportation utility can raise the volume of vehicles in Surabaya road and can cause problems of congestion, during peak hour. Here are the several location points which have sensitive traffic condition in Surabaya.

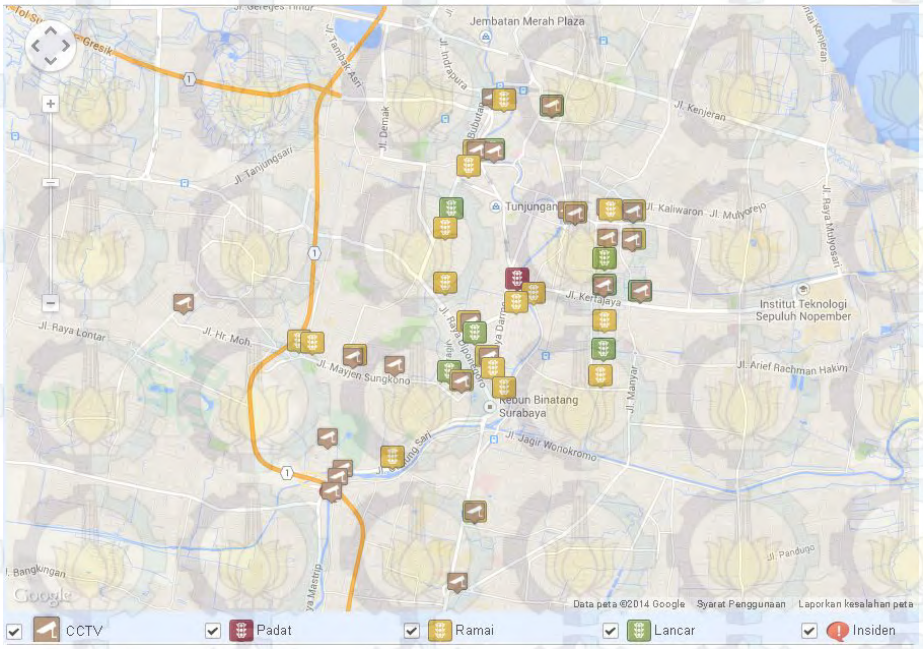


Figure 1.1 Transportation Density Map of Surabaya
Source: (Dinas Perhubungan Kota Surabaya, 2014)

Based on Figure 1.1, the high density of vehicles is mostly located in center of Surabaya city. It has a lot of access route for transportation mobility, notably employees and student. The crowded areas are mostly in Jl. Darmo, Jl. Kertajaya, around of Surabaya Zoo, and Jl. HR. Mohammad (Dinas Perhubungan Kota Surabaya, 2014).

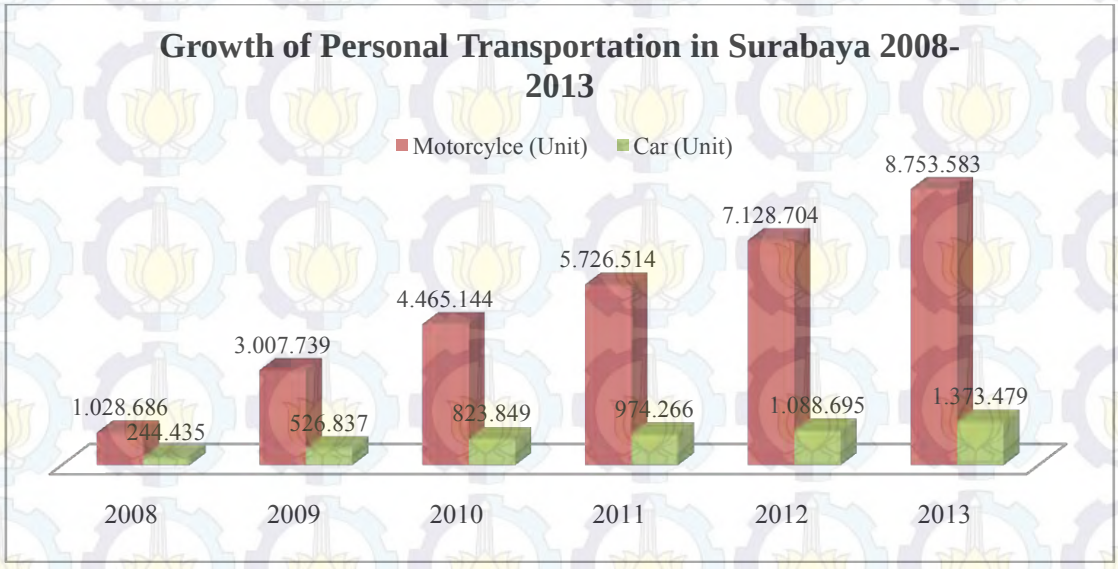


Figure 1.2 Private Transportation Growths in Surabaya
Source: (Dinas Perhubungan Kota Surabaya, 2013)

Private transportation in Surabaya has significantly increased in five years. The highest increasing point is experienced by motorcycle in 2013 which has eight times of total motorcycle in 2008. It exceeds the number of current social population and makes over capacity of mobility access in Surabaya.

An effort for solving the problems is described above such that congestion, limited land for construction of roads, inefficient passenger trips, and increasing of air pollution caused by over use of private vehicles. It needs an effort to provide mass transit which has a sustainable transportation. MRT (Mass Rapid Transit) is an urban transportation system which has 3 main criteria, mass (large haulage), rapid (faster travel time and high frequency), and transit (stop at many stations in the urban main point) (Austengineer, 2012). This transportation usually operates in dedicated or exclusive and separated route from the other public transportation. It also has specific operation schedule based on society peaking hours. There are a lot of types of MRT system, such as Bus Rapid Transit (BRT), Commuter rail systems, Light Rapid Transit (LRT), and etc (Austengineer, 2012). This system has been adopted and successfully implemented in several countries, such as Singapore, Thailand, and China. Jakarta is the city of implementing MRT in Indonesia, with bus way and commuter line as MRT transportation.

MRT system can support the city advancement in moving rapidly. It is related by the social willingness to change their private vehicles to MRT transportation. This changing considers about service quality, cost efficiency and environmental impact, compared to cost of fuels.

Willingness to pay is the one tool to understand the total users think the product or service will be worth in other side of spending cost (Foreit et al., 2004). This approach also can measure the feasibility of project or product before launching. Some issues which have used this approach are setting or determining service cost, feasibility of launching product or project, and analyzing sensitivity of socio economics status. Nowadays, there are feasibility researches related to measure society willingness and readiness to change into public transportation in several developing countries by using willingness-to-pay approach.

By this way, Surabaya as the one of big cities in Indonesia also has develop MRT or *Angkutan Massal Cepat* (AMC) system to support social mobility infrastructure. It is called Surabaya Mass Rapid Transit (SMART) project.

Figure 1.3 Visualization of Surabaya Monorail
Source: smart.surabaya.go.id, 2013

This project is one of acceleration of socio economic masterplans in Indonesia. According to *Badan Perencanaan Pembangunan Kota Surabaya*, the project will be launched in 2015 to solve the congestion and fuels consumption problem in Surabaya. SMART project has two kinds of public transportation, Boyorail and Surotram. For example in Figure 1.3, the route of Surotram will pass Jl. Pasar Keputran and Jl. HR Muhammad, for Boyorail will pass Jl. Darmo and Jl. Basuki Rahmat. Both of SMART transportations project have been observed by several feasibility approaches. However, it still needs another approach to measure the social, economic, and environment factor.

The highest subsidized BBM is allocated to transportation fuels. It means that government will increase their expenditure to buy and import BBM. However, the availability of fossil fuels energy becomes less and more expensive.

Indonesia has to spend RAPBN more than 100,000 billion rupiahs for subsidizing transportation fuels. Its value can increase for this year and the next year. BBM information shows the quantity of transportation in Indonesia also grows up. Here is the government expenditure for BBM consumption in 2011 until 2013.

Table1.1 Government"s Expenditure for BBM Consumption 2011 until BBM Consumption in Indonesia

Jenis	2011 *)	2012 (APBN)	2013 (RAPBN)
Nilai Subsidi (milyar rupiah)	129.723,6	137.379,8	193.805,2
Volume BBM (ribu kiloliter)	40.331,4	40.000,0	46.010,0
- Premium	24.538,2	24.411,3	29.200,0
- Minyak tanah	1.694,8	1.700,0	1.700,0
- Solar	14.098,4	13.888,7	15.110,0

Source: (Anonymous, 2013)

In 2013, Surabaya government did not implement restriction for any new private vehicle entering the city, so it made the city more crowded (Surabaya Kita Editorial Staff, 2013). In that year, government had significant increasing of fuels expenditure up to 41% of previous year. This rising cost of fossil fuels caused the government capability to provide BBM lower and may be not able to purchase it. Here is the data of BBM consumption and subsidized in Indonesia.

Table 1.2 BBM Consumption in Indonesia

Tahun	Kuota			Realisasi			
	Premium	Solar	Subsidi BBM	Premium	Solar	Subsidi BBM	
						Volume *	Nilai
	(Juta KL)	(Juta KL)	(triliun rupiah)	(Juta KL)	(Juta KL)	(Juta KL)	(triliun rupiah)
2007	16.58	9.87	54.10	17.92	10.88	38.60	83.80
2008	16.97	11.00	126.80	17.94	11.75	39.20	139.10
2009	20.94	11.81	52.30	21.18	12.06	37.70	45.00
2010	21.45	11.20	89.30	22.93	12.94	38.40	82.40
2011	24.50	14.06	129.70	25.50	14.50	41.70	165.20
2012	27.84	15.00	137.40	28.24	15.56	45.07	219.90
2013	29.03	14.28	199.90	29.26	15.88	46.83	210.00
2014	32.32	14.14	199.80	7.10	3.85	11.20	-

Source: BPH Migas, Pertamina, 2014

The main consideration of implementing SMART project is tradeoff between fuels consumption and transportation cost. Based on Table 1.2, in 2013, the government had planned subsidized BBM arround 199.90 trillion rupiahs, but in the realization, it had consumed more than what had been planned before. Indonesian government had planned subsidized BBM consumption up to 199.80 trillion rupiahs in last year. That number is allocated to premium 32.32 million kiloliter and solar 14.14 million kiloliter.

The objective of this study is to measure social readiness and willingness to pay (WTP) for mass rapid transit, monorail and tram attribute that support public transportation service. The other objective is recommending the cost of monorail and tram. To fulfill this objective, a choice experiment survey was observed to Surabaya society. Random Utility models are employed to analyze the survey data. To our knowledge, no study has addressed the problem of implementing new transportation mode from perspective of the general public‟s WTP services that enhance the quality of transportation facility.

1.2 Problem Identification

The main problem of this research is to know the society willingness and readiness of implementing public transportation Boyorail and Surotram in Surabaya City.

1.3 Objectives and Benefits

There are objectives and benefits of measuring social willingness for the sustainable SMART project of Surabaya City. Here are objectives and benefits of researching society willingness and readiness.

1.3.1 Objectives

The objectives of this SMART willingness-to-pay obseravtion are:

1. To measure the level of social readiness to use and willingness to shift Monorail and Tram.
2. To analyze the social willingness to pay attributes of Mass Rapid Transit, Monorail and Tram transportation.

3. To give cost recommendation for Monorail and Tram transportation.

1.3.2 Benefits

This research will get benefit as the one of consideration for government and related institution about the society willingness and readiness of Boyorail implementation feasibility in Surabaya city.

1.3.2.1 For Government

The benefit of this research for government is to know the feasibility of SMART project Boyorail and Surotram in Surabaya by considering socioeconomic development infrastructure aspect.

1.3.2.2 For Researcher

The benefit of this research for researcher is to know the social willingness for SMART project by considering the appropriate transportation price.

1.4 Research Scope

This research scope is divided into two parts, limitation and assumption. Here are the research limitation and assumption:

1.4.1 Scopes of Study

Here are the limitations of society willingness research about Monorail and Tram implementation:

1. The research concerns only for Surabaya Mass Rapid Transit (SMART) monorail and tram transportation type.
2. The research target focuses to employee, senior high school, and junior high school student or who use private transportation.
3. The survey area of research is only in Surabaya City.

1.4.2 Assumptions

Here are the assumptions of society willingness research about Boyorail implementation:

1. The route of monorail and tram transportation do not change during the research.
2. The locations of monorail and tram station have fixed.
3. The result of survey data can represent the existing condition.

1.5 Research Outline

This research outline consists of report in detail explanation about the content of each chapter. Here is the research outline of this research report.

CHAPTER 1 INTRODUCTION

This chapter consists of background of doing this research, problem identification that will be solved, research scopes which contains of assumption and limitation, research objectives and benefits, and research report outline.

CHAPTER 2 LITERATURE REVIEW

This chapter consists of theoritical guidance from several literatures and references which will support researching process to determine the appropriate method based on the existing problem.

CHAPTER 3 RESEARCH METHODOLOGY

This chapter consist of research methodology which has several steps for doing research. Those steps have sistematic and structured procedure that should be done by researcher during the research assesment. It explains the method how to collect the data and what the main types of data that should be collected.

CHAPTER 4 DATA COLLECTION AND PROCESSING

This chapter contains two parts. First, it consists of data collection which consists of the result of collected data from survey questionnaire. Second, it contains data processing which explains how to process the collected data.

CHAPTER 5 DATA ANALYSIS AND DISCUSSION

This chapter consists of the analysis and discussion of the result of data processing, mainly in readiness to use, willingness to shift, and willingness to pay.

CHAPTER 6 CONCLUSION AND RECOMMENDATION

This chapter consists of the research conclusion and recommendation for the final project.

1.6 Research Scheme

This part explains about the scheme of measuring readiness and willingness to pay of SMART, monorail and tram: a survey research.

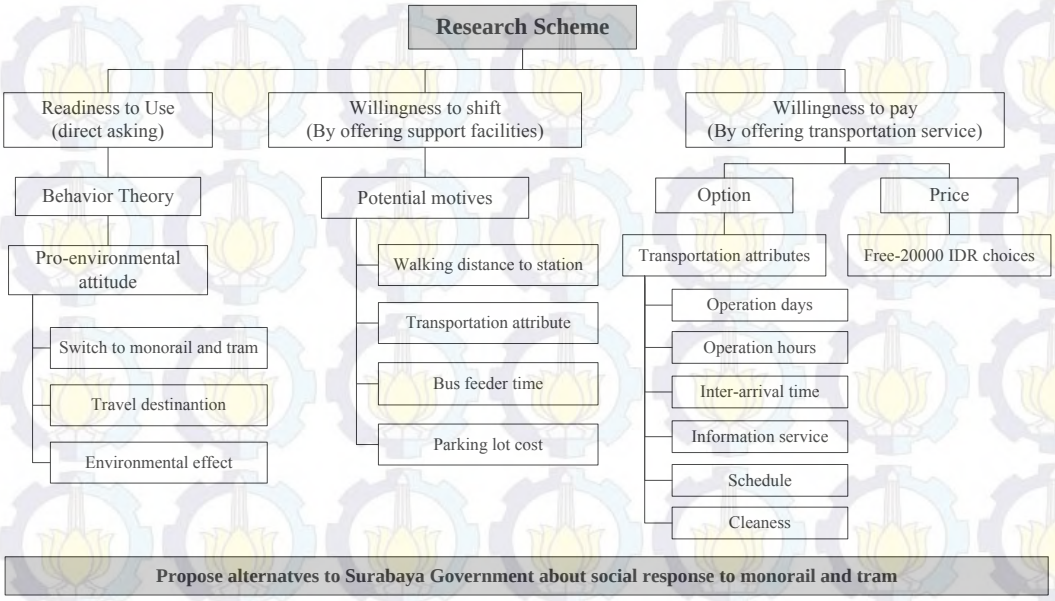


Figure 1.4Research Scheme of Measuring Readiness and Willingness to Pay of SMART

There are three parts of study, readiness to use, willingness to shift, and willingness to pay. Readiness to use measures the direct response from society about monorail and tram. This part shows the behaviors from society after hearing the new transportation mode. It measures the level of readiness about implementing Boyorail and Surotrem in some point of views, especially for those three factors. Each factor will be valued in ranking scale. In other hand, willingness to shift offers several support facilities for MRT mode. It shows several potential motives to change into MRT. Some of them measure the tolerance service in each support facility. This study explains what the customer wants about support facility. It can be used to consider the proposed facility service as government strategy in managing the urban transportation system.

Similarly, willingness to pay also offers transportation attributes and price. If there is detail information, respondent will consider twice choosing “willing” or “unwilling”. Good service quality will interest them to choose willing decision. So, in this part shows the preferred option or transportation attributes for each

Boyorail and Surotram and the maximum price of their willingness. This study also used to help government in taking decision. As result, the result of proposed transportation attributes can contribute in designing MRT transportation system, such as implementation, operational, maintenance, pricing ticket, and etc.

CHAPTER 2
LITERATURE REVIEW

This chapter consists of several resources and theoritical guidance from several literatures and references supporting research process to determine the appropriate method based on the existing problem.

2.1 Public Transportation

Transportation is the movement of things from a certain initial point to end-point which represents of supply chain system to fulfill customer demand (Chowdhury, 2001). Transportation is public facility providing people with mobility and access to employment, education, retail, health and recreational facilities, as well as community facilities (Queensland, 2014). Public transportation includes the use of rails, buses, ferries, taxis, and etc. It aims to reduce traffic congestion, travel times, and air pollution, also to provide economic opportunities, and to improve efficiency of road system (Western Brisbane, 2008), as the impact of sustainable transportation is Mass Rapid Transit development.

2.1.1 Surabaya Mass Rapid Transit (SMART)

Surabaya Mass Rapid Transit is the government project which concerns in improving public transportation service and quality in big city (Vanany, I. et al, 2014). SMART has several transportation types. The concerned types of SMART project for this research are Monorail and Tram.

2.1.1.1 Monorail

Monorail is a railway with single rail in its track and has size larger than the rail. Commonly, the rail is made of concrete and its wheel is made of fiber. The advantages of Monorail are:

1. It is lighter in weight and less noisy than traditional train.
2. It only needs small space in vertical and horizontal because it is constructed on the buffer pole for holding it. So, it has mobility access in the middle of road with lower accident risk, especially collision case.

3. It can operate faster than traditional train in several frequencies because of using electrical source.
4. It has low cost and easy to be constructed and maintained because of the material made of fiber and concrete (Khairani, 2014).

Meanwhile, it also has disadvantages which are:

1. Monorail needs more space compared to underground train.
2. In emergency condition, the passenger cannot be directly evacuated except in the station location (Khairani, 2014).

Here are Figure 2.1 and Figure 2.2 show the logo and design of Surabaya Monorail transportation.

Figure 2.1 Boyorail Logo (ITSnet, 2013)

Figure 2.2 Design of Boyorail Transportation (Surabaya Mass Rapid Transit, 2013)

Surabaya government has defined the fix route of Boyorail Transportation. Route of Surabaya Mass Rapid Transit for East-West corridor is assigned by Boyorail and its mode.

2.1.1.2 Tram

Here are Figure 2.3 and Figure 2.4 show the logo and the design of Surabaya Tram transportation.

Figure 2.3 Surotram Logo (ITSnet, 2013)

Figure 2.4 Design of Surotram Transportation (Surabaya Mass Rapid Transit, 2013)

The route of SMART for North-South is assigned by Surotram and its mode. Boyorail and Surotram are categorized into straddle-beam (operate on rail). Their design based on the approach result of *Dinas Perhubungan and Badan Perencanaan Pembangunan Kota* (Bappeko) Surabaya which included on Home Interview Survey, Transportation Industry Survey, Demand Modeling Study, Public Transportation Planning Study, Feasibility Study of AMC, Designated Study, and group discussion in Bappeko Surabaya with several Universities. The route and station of Boyorail and Surotram can be seen in Figure 2.5.

Figure 2.5 Routes Plan of Surabaya Monorail and Tram (Dinas Perhubungan Kota Surabaya,2012)

On Figure 2.5, Boyorail has track until 26.21 km with 21 stations from East to West Surabaya and Surotram has track until 18.18 km with 23 stations from North to South Surabaya. According to Surabaya Mass Rapid Transit, 2013, the implementation of Boyorail and Surotram is also supported by other facilities where it can be used to improve both transportations mode, consisted of:

1. Monorail Depot

   The location of Monorail Depot will be planned in Sentra Bulak, Kenjeran and Joyoboyo which needs available space around 2.5 hectare.
2. Monorail and Tram Station
3. Park and Ride Facilities

   Park and ride is a parking lot facility located in the suburban area or a location where the venue is close to public transport stops which will be heading to the city center. Park and ride locations will be planned in Surabaya City Government land or private sector land, including:

   - Kantor Dinas Pariwisata
   - Pasar Tunjungan
   - TVRI
   - Ahmad Yani (EX IGLAS)
   - Jl. HR Muhammad.

In other hand, MRT designs show their specifications, such as capacity, total unit, total stops, demand, and etc. Here is the specification of MRT, monorail and tram.

VARIABEL	MONORAIL	TRAM
CORRIDOR LENGHT	31 KM	23 KM
DEPO LOCATION	KEPUTIH	JOYOBOYO
TOTAL STOPS	25 UNIT	36 UNIT
AVERAGE DEMAND /YEAR (IN 2025 – BASED ON MODELLING STUDY BY THE WORLD BANK)	53.942.104	40.737.896
*INVESTMENT(IDR)	6.417.096.450.824	2.413.004.100.000
CAPACITY/CIRCUIT	400 PSG (± 177 SEAT ; 238 STANDING)	200 PSG (200 PASSENGERS)
ECONOMICAL FARES	21.500	11.000
HEADWAY	10 MIN	10 MIN
WILLINGNESS TO PAY (WTP)	6.348-9.119	6.348-9.119
SUBSIDY/PASSANGER	11.500**	4000**
NEED FOR FLEET	18 trains (4 carriage)	21 trains (5 carriage)

Figure 2.6Monorail and Tram Model Specification
Source: (Badan Perencanaan Pembangunan Kota (BAPPEKO), 2014)

Those data comes from forum group discussion and brainstorming between BAPPEKO, PT. KAI, and related research institutions. This MRT specification becomes the reference to calculate cost recommendation and to compare result of direct survey. The considerations of determining monorail and tram tariff are MRT capacity, need for fleet, demand, and total stops. The calculation of cost recommendation based on MRT specification is served into next chapter.

2.2 Readiness Concept

Several researches of mass rapid transit (MRT) transportation are related to factors based on behavior theory. This theory concerns to environment, value orientation, and relationship to a pro-environmental attitude (Garling et al, 1998; Nilsson and Kuller, 2000). Those factors are generated to measure the social readiness level of using MRT transportation and willing to leave the private transportation. Nilson and Kuller (2000) believe that social pro-environmental attitudes can cause them willing to choose MRT than their private transportation. In this research, pro-environmental attitude becomes as factor of social readiness

measurement to MRT project in Surabaya. Here are pro-environmental attitude factors become as MRT readiness factors, monorail and tram.

Table 2.1 Readiness Factors of Monorel dan Tram

Factor	Author	Sub Factor	Question
1. Switch to Monoraill and Tram	(Hiscock et al., 2002)	1.1 Reduce private transportation	Do you willing to switch to use Monorail and Tram?
	(Nasrudin, 2013)	1.2 Station distance	Do you willing if the station has maximum distance 1 km from living place/home?
2. Travel Motives	(Minderhoud, 2005)		2.1 Do you willing if the station is located near to government center?
			2.2 Do you willing if the station is located near to education facilities (school/university)?
			2.3 Do you willing if the station is located near to vacation place?
			2.4 Do you willing if the station is located near to shopping center?
3. Environment effects	(Istamto et al.,2014)	3.1 Congestion	Do you willing to change into using Monorail and Tram to reduce congestion?
	(Tarmizi et al., 2014)	3.2 Pollution	Do you willing to change into using Monorail and Tram to reduce pollution?
	(Anable, 2005)	3.3 Accident	Do you willing to change into using Monorail and Tram to reduce accident occurrence?

Readiness concept with giving several factors can be defined as social willingness standard or reference to switch to MRT transportation. Those factors above come from the previous researches related to the same problem, transportation. The whole factor will be directly given to respondent to know the social readiness level and pro attitude of monorail and tram.

The measurement method of readiness uses ranking score 1 until 5. By this way, it can be known how much will be agreed or refused to change monorail and tram transportation. It also can be analyzed by using the gap of gender, the private transportation types, daily transportation, and income factor. The behavior

of Surabaya population about monorail and tram can be shown by using several statistics and graphics.

2.3 Willingness to Pay Concept

Willingness to pay (WTP) is the reflection of the total consumer or user maximum think that the product or service will be worth (Foreit et al., 2004). In this case, it means the social willingness to change the daily use of private transportation into public transportation by paying the offered facilities. The WTP approach uses user or society perception about public transportation cost (Wahyuni et al., 2011). WTP measurement may be influenced by one or more social-economics characteristics, such as age, gender, income, household sizes (Phanikumar & Maitra, 2007). There are two ways to do willingness to pay research based on the existing data or certain research and by using survey. Here is the method classification of measuring willingness to pay.

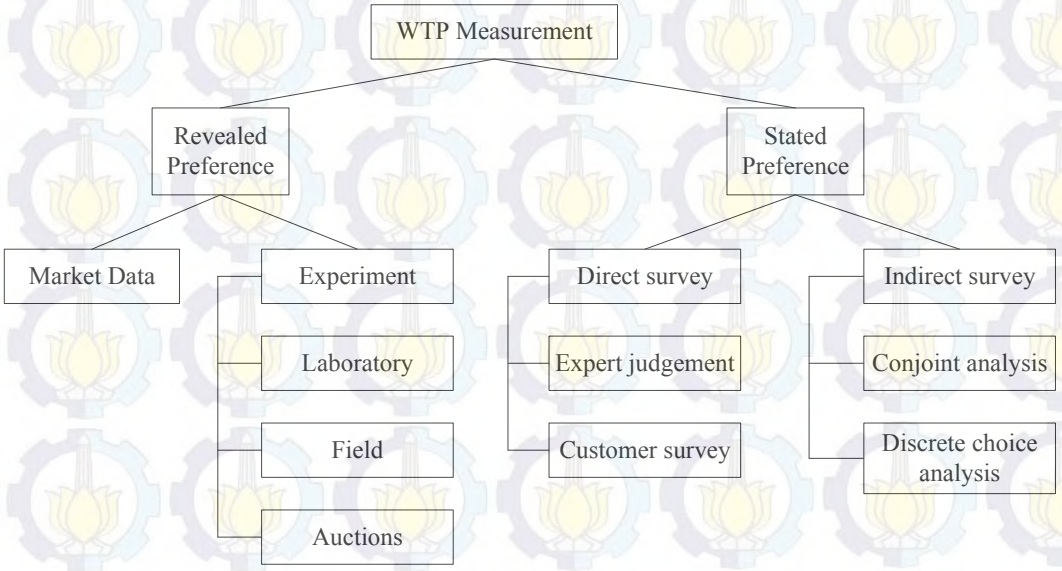


Figure 2.7 Classification of Willingness to pay Method (Breidert et al, 2006)

Breidert et al (2006) have succeed to classify the willingness to pay methods into two big groups: (1) revealed preference and (2) stated preference. Revelead preference method can be obtained by using market data and doing experiments. For experiment methods, they can use experiment in the laboratory

(laboratory experiments), field (field experiments) and auctions. Stated preference method is more based on survey method which divided into two types, and indirect surveys. Direct survey can use expert judgement method and customer/ passanger surveys. Meanwhile, indirect surveys can be done by using conjoint analysis and discrete choice analysis.

This research prefers to use stated preference with direct survey. There are several advantages of conducting direct surveys or questionnaire. It can collect large amounts of information from a large number of people in short period of time and cost effective way. It can be analyzed more scientifically and objectively than other research ways. In other hand, it cannot show how truthful a respondent is answering the questionnaire. It also cannot describe some information, such as changes of emotions, issues, and behavior. This research is about launching new public transportation mode which has not realized before. As the result, the direct survey is the suitable method to get the objective answers and primary data.

Some researches of measuring WTP have been done in reducing air pollution, congestion, and noisy, reducing accident occurrence, reducing travel time, improving transportation information services, lost private license (Eboli & Mazulla, 2008). When someone is wanted willing to pay, there are some support attributes becoming as willingness potentials or motives. It is related to willingness to shift (WTS) used to analyze the potential factors influencing to switch. Rastogi (2010) had been done research about WTS which has purpose to promote walking and bicycling in area of rail access India. He analyzed the social-economics factor of society by giving questionnaire contained “Yes” or “No” questions. Both WTS and WTP have the same evaluation.

In WTP, the decision maker chooses the best one among available alternatives, taking into account a non-compensative decision process, in which any attribute is compared with the relative threshold (cut-off). In the latter, the decision maker weights remaining alternatives by a compensative decision process considering their different attributes (Swait, 2001). Here are the choice alternatives of WTP.

Table 2.2 Choice Alternative of Willingness to Pay

Attributes	Option 1	Option 2	Option 3
Operation Days	Monday-Friday	Seven days	Seven days
Inter-arrival time	More than 15 minutes	Every 15 minutes	Every 10 minutes
Schedule	Free (no schedule)	Scheduled	Scheduled
Operation Hours	5 morning – 6 evening	5 morning – 10 night	5 morning – 12 night
Monorail and Tram Facilities			
Cleanness	Enough	Keep cleaned	Keep cleaned
Information Service	Journey map, no schedule, delay announcement	Journey map, schedule, delay announcement	Journey map, schedule, delay announcement, operator
Choice box	□	□	□

This choice experiment will show the coefficient value of each attribute. It is used to evaluate the positive WTP for transportation attribute. That method uses questionnaire to show the alternatives choice in determining the measured individual characteristics and serves several alternatives with some different variables. It also needs to spend a certain cost as the compensative side of each option. Because there is no available data about cost estimation of transportation option, it uses ratio number. Here is the estimated cost of transportation option.

Table 2.3 The Estimated Cost of Transportation Option

Estimated Cost	Option 1	Option 2	Option 3
Investment cost			
Monorail and Tram Station	1	1	1
Monorail and Tram Unit	1	1	1
Operational Cost			
Maintenance cost			
Operation days	1	2	2
Inter-arrival time	1	1.5	2
Operation hours	1	1.5	2
Cleaness	1	1.5	1.5
IT and Resource cost			
Information cost	1	2	2
Human Resource cost	1	1	1.5
Total	**8**	**11.5**	**13**

Those numbers in Table 2.3 only the estimated ratio of spending cost for transportation attribute. The higher number means that it is more costly. This willingness to pay describes two outcomes, the percentage of individual WTP for transportation attributes in each option.

2.4 Measuring Willingness to Pay

In measuring willingness to pay of transportation, there are several methods consisted Random Utility Model, Contingent Valuation Method, and Sampling Techniques. Both methods RUM and CVW are the methods to process the data of WTP questionnaire. This research conducts direct survey, so sampling technique becomes an important part of doing research.

2.4.1 Random Utility Model

A popular method, the maximum likelihood estimation method used for the calibration of Logit Models provides asymptotically distributed multivariate normal parameters (BeN-Akiva & Lerman, 1985). Logit Models approach or discrete choice models which uses to find the probability transformation from $-\infty$ to $+\infty$ with limited value of 0 to 1 (Schwarzlose, et al., 2014). This method is based on Random Utility Theory. This model measures the probability of individual which derives more utility from the chosen alternative than from those alternatives not chosen. It usually uses binary or binomial discrete variables. This method can be suitable for new public transportation projects. It analyzes the probability of each attributes in different area, and then will be searched the result of comparison in each attribute levels (Schwarzlose, et al., 2014).

$$\boldsymbol{U_{int}(x_{int}, w_{it}) = z_{int}, \beta + \varepsilon_{int} = x_{int}, \delta + w_{it}, \gamma + \varepsilon_{int}} \quad (1)$$

where β, δ, and γ are vectors of parameter to be estimated, and the error term is denoted as ε_{int}. The RUM assumes utility maximization by using regression such that decision maker *i* will choose alternative *m* over *n* in the choice scenario *t*, if and only if.

$$\boldsymbol{U_{imt}(x_{imt}, w_{it}) > U_{int}(x_{int}, w_{it})} \quad (2)$$

The made assumptions come from the distribution disturbance and whether the coefficients are fixed or varying across individuals in RUM model led the use of various qualitative models to estimate RUM (Greene, 2006).

2.4.1.1 Logistic Regression

Logistic regression is a method to process two values of choice. According to Mubarok (2011), commonly, those two outcomes of the response variable consist of "success" and "failed" or "yes" and "no". Both of outcomes are represented by 1 for a success and 0 for a failure. The mean is then the proportion of 1, $p = P$ (success). Logistic regression models the mean p in terms of an explanatory variable x. The statistical model for logistic regression is

$$\log\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 x_1 \quad (3)$$

$$odds = \frac{p}{1-p} \quad (4)$$

Where p is a binomial proportion and x is the explanatory variable. The parameters of the logistic model are β_0 and β_1. Logistic regression works with odds rather than proportions (Moore et al., 2011). The odds are the ratio of the proportions for the two possible outcomes. If p is the probability of a success, then $1 - p$ is the probability of a failure.

2.4.2 WTP Estimation for Transportation Options

After doing calculation about coefficient of each attributes, the next estimates the level of social willingness to pay of each transportation options. The estimated coefficient based on random utility model associated with the estimated tariff of MRT transportation be β_s and estimated mean parameter for transportation attribute k be β_k. The value of β_s is constant and β_k is assumed to vary among individuals. The assumptions allow WTP to take on the same distribution as normal distribution. WTP for transportation attribute k comes from:

$$\boldsymbol{WTP_k = -\frac{\beta_k}{\beta_s}} \quad (5)$$

The value of individual having a positive WTP for transportation attribute is:

$$\boldsymbol{percent} = \boldsymbol{(1 - \varphi(WTP_k))x\ 100} = \boldsymbol{\left(1 - \varphi\left(-\frac{\beta_k}{\beta_s}\right)\right).100} \quad (6)$$

where $\varphi\left(-\frac{\beta_k}{\beta_s}\right)$ represents the normal cumulative distribution function evaluated at $-\frac{\beta_k}{\beta_s}$ (Schwarzlose et al., 2014).

2.4.3 Sampling Technique

Sampling technique is the way to determine the minimum number of sample or the candidates of sample where these numbers can represent the whole population and its characteristics (Martadiputra BAP, 2011). Generally, there are two types of sampling methods, random or probability sampling and non-random sampling. Random sampling includes of simple random sampling, disproportionate stratified, stratified random sampling, and clustering. Besides, non-random sampling consists of quota, selective, systematic sampling, convenience, snowball sampling, and etc (Fox et al., 2009). As this case of the quantitative research and the target of sampling have socio-demographic class, the suitable sampling method is proportionate stratified random. But, there is no source showing the proportion population of each socio-demographic class. As the result this research uses simple sample size calculation based on the number of population.

The sample size calculation formula that most people are familiar with it, what is called an infinite population assumption or large population assumption (VALID International Ltd., 2006). In contrast, this research has the fixed data of total actual population. One of simple method of finite random sampling is Multistage Random Sampling by using Slovin‟s Formula. This formula can be used if there is no information about population behavior.

$$\boldsymbol{n} = \frac{\boldsymbol{1/e^2}}{\boldsymbol{1+\frac{1/e^2}{N}}} = \frac{\boldsymbol{N}}{\boldsymbol{1+Ne^2}} \quad (7)$$

Where *N* is the number of population, *n* presents the number of sample size, and *e* for the standard error or alpha. The constant value 1 means that the critical *z*-value in Cochran formula is exactly equals to 2.

To make inferences on the population proportion *P* under simple random sampling without replacement (SRSWOR), Cochran formula presents the derivative Slovin‟s formula for sample size when working within a finite population:

$$n = \frac{z^2 p(1-p)/e^2}{1+\frac{z^2 p(1-p)/e^2}{N}} = \frac{z^2 p(1-p)N}{z^2 p(1-p) + Ne^2} \quad (8)$$

Where *z* presents the critical value of confidence level and *p* estimates the respondent distribution, the most conservative assumption is 50% for normal distribution. As the composition of that formula, the basic requirements are those two entities. This formula can be applicable if the research uses 95 % degree of confidence level because z value equals to 1.96 (Tejada and Punzalan, 2012).

2.5 Previous Research Review

Public transportation problem becomes one of attention in several major in Industrial Engineering. A lot of researches have related to social readiness and willingness measurement of public transportation. Each author analyzed a certain dominant aspect which affects social readiness and willingness for public transportation. Here are the several previous researches about social readiness and willingness to pay.

Table 2.4 Previous Researches of Social Readiness and Willingness to Pay

Author	Research	Method	Result
(Phanikumar & Maitra, 2007)	*Willingness-to-Pay and Preference Heterogeneity for Rural Bus Attributes*	Multinomial Logits	Shows heterogeneity associated with the mean is investigated, and the travel distance is found to have a statistically significant decomposition effect on the mean of in-vehicle travel time for commuting trips
(Nasrudin et al., 2013)	*Urban Residents" Awareness and Readiness for Sustainable Transportation Case Study: Shah Alam, Malaysia*	Statistics Summary	A significant association exists between the level of willingness to reducecar usage and the age of respondents
(Schwarloze et al., 2014)	*Willingness to pay for public transportation options for improving the quality of life of the rural elderly*	Random Utility Model	Shows the positive willingness to pay of each transportation attributes in each survey area
(Ramayana et al, 2007)	*Quality Expectations of Transport Services and Willingness to Pay: Case of KSRTC*	Multinomial Logits	The preferable and willingness to pay transport service

Author	Research	Method	Result
(Lera-Lopez et al., 2014)	*Evaluating factors of the willingness to pay to mitigate the environmental effects of freight transportation crossing the Pyrenees*	Double Hurdle and Moultan Model	Shows the more aprriciated environmental effect and the socioeconomics factor of willingness
(Eboli & Mazzula, 2008)	*Willingness-to-pay of public transport users for improvement in service quality*	Multinomial Logits	Providing tool to calculate willingness to pay of public transportation by calibrating two models
(Santi, 2011)	*Analisa Willingness-To-Pay Sektor Industri Bagi Penggunaan Air Kali Brantas Menggunakan FUZZY MCDM (Studi Kasus: Daerah Aliran Sungai Brantas, Jawa Timur)*	Fuzzy MCDM	Comparing willingness to pay"s price with the real price taken by Jasa Tirta.
(Rastogi, 2010)	*Willingness to Shift to Walking or Bicycling to Access Suburban Rail: Case Study of Mumbai, India*	Statistics Summary	Shows the user behavior factors influenced the result of willingness to shift of transport improvement

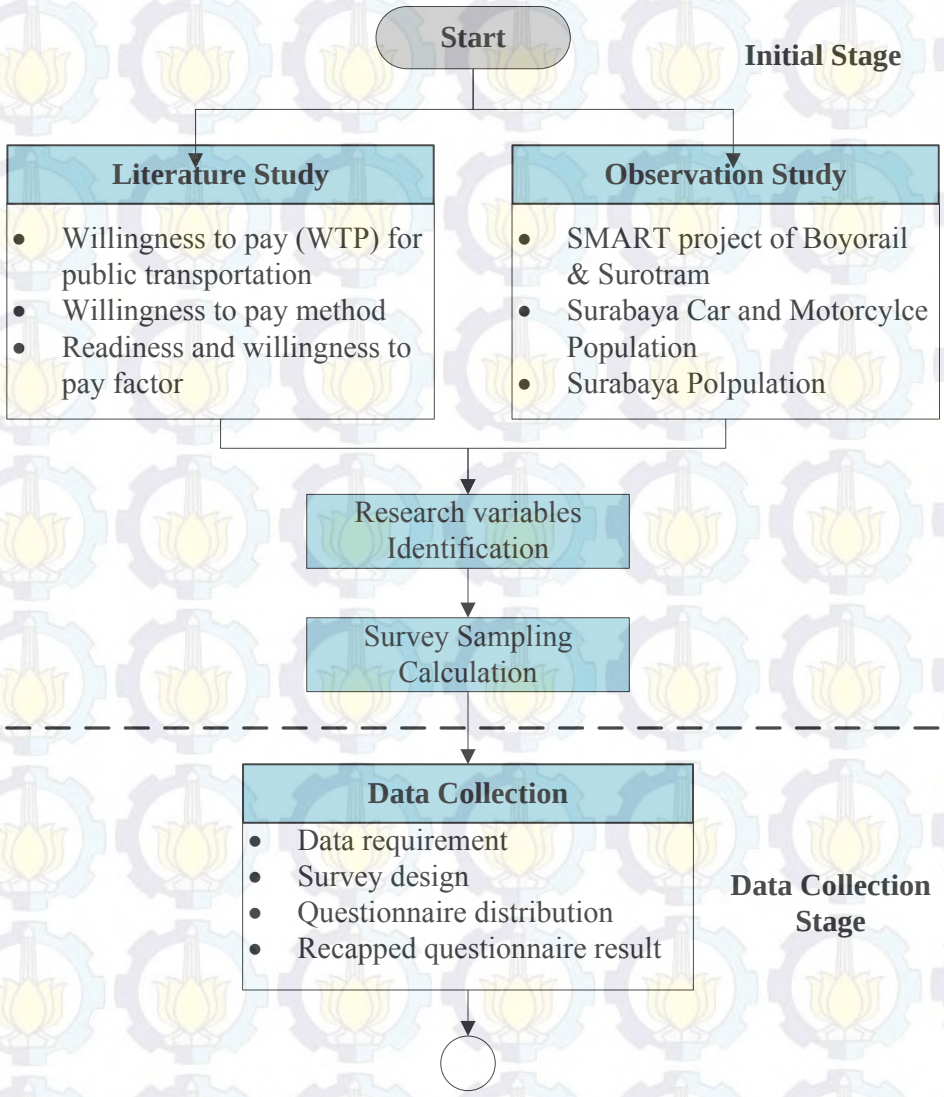
However, there are a few researches of reducing air pollution and economics growth caused by MRT, monorail and tram. The range of monorail and tram ticket cost has been determined by Surabaya government without doing comprehensive study by using direct survey and interview to society.

CHAPTER 3
RESEARCH METHODOLOGY

This chapter consists of research stages or what have to be done in applying this final project by researcher. This methodology is overall approach for final project process in systematic model. This final project steps are initial steps, data collection and processing, data analysis and interpretation, and conlcusion.

3.1 Research Flowchart

Here is the flowchart of readiness and willingness to pay of Surabaya Mass Rapid Transit, Monorail and Tram research served in Figure 3.1.



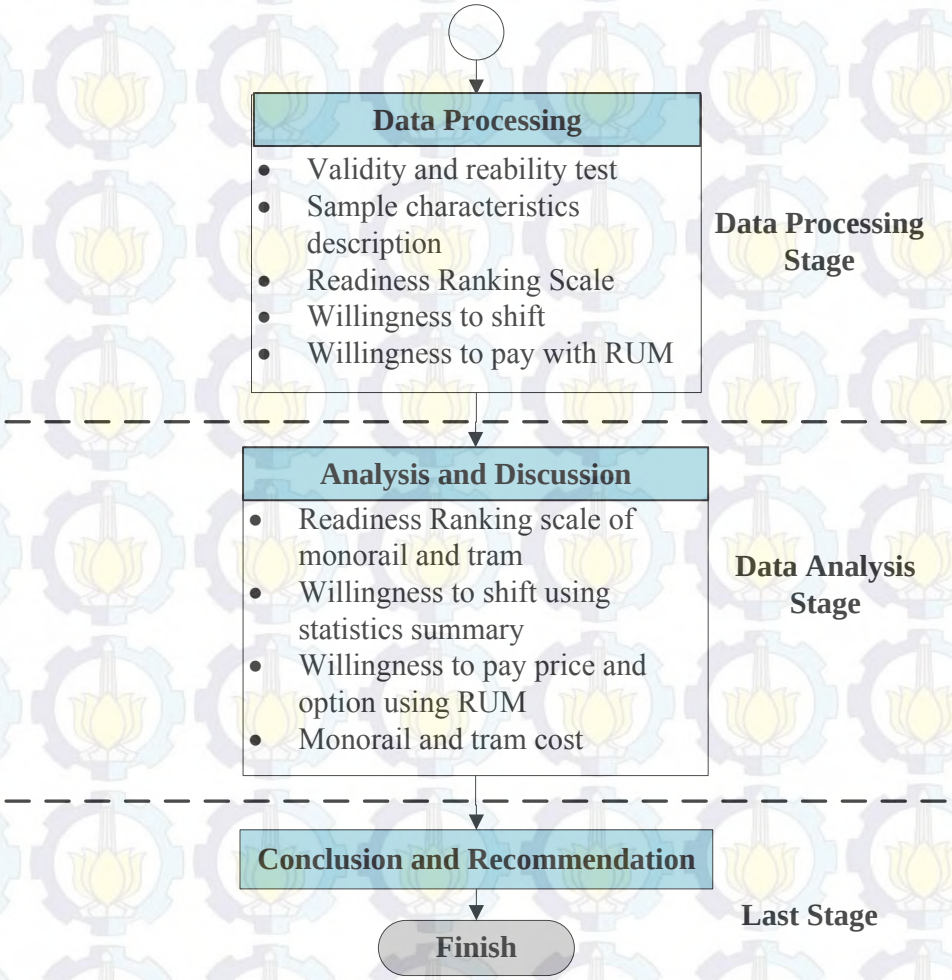


Figure 3.1 Research Flowcharts of Readiness and Willingness to Pay of MRT, Monorail and Tram

3.2 Initial Stage

This initial stage consists of literature study, observation study and variable identification. It is used to know the progress of implementing MRT in Surabaya and to find the related theory in this research.

3.2.1 Literature Study

This step is used to choose the related literatures review to support the final project solution. Those literature studies are used to find the appropriate theories to solve the willingness problem, such as concept or method. The relevant methods are collected from the previous researches. They will be considered by

several factors in the existing condition to get the best way of measuring SMART project feasibility and society willingness.

3.2.2 Observation Study

This part conducts to real observation to get the detail information about the existing condition of research object. Researcher must find the critical problem to conduct an experiment or observation to get the solution. This research observed SMART implementation progress and its obstacles. Then determining objective, it is the determination of final project target as the main purpose to solve the existing problem. This part consists of what will be reached from measuring willingness and readiness of SMART transportation, Monorail and Tram. Those observation studies can be collected by interviewing Surabaya Government and the responsible institutions to known the SMART project location and target, monorail and tram.

3.2.3 Variable Identification

Before making questionnaire design for data collection, so it needs to determine the influenced variables of preferred data, such as:

1. Respondent characteristics of some socioeconomic information, such as gender, job, income, and etc. (Ortuzar, 2001)
2. Readiness factors of using monorail and tram have been explained in the previous chapter (change to monorail and tram, travel destination, and environmental impacts)
3. Several alternatives of willingness to pay like as facility and proposed MRT cost.

The identified variables are become the calculated variables by using the chosen formula. The collection process of questionnaire is done after the variable identification process has been finished.

3.3 Research Methodology Formulation

The purpose of research methodology is the guidance to determine the steps of doing research. In formulating methodology, the researcher should know

what the appropriate methods or approaches to solve the existing problem. As the result, the steps of doing research can be defined based on the requirements of the chosen method or approach.

3.3.1 Survey Sampling

This research sampling targets are employees, university and senior high school student, and a few household societies. The quantity of sample is based on the region number in Surabaya city. Surabaya city is divided into 31 regions. The population number of each region becomes the input of calculating sample size.

The preferred method for random sampling has been explained in previous chapter, Cochran. Cochran formula presents the derivative Slovin‟s formula for sample size when working within a finite population:

$$\boldsymbol{n = \frac{z^2 p(1-p)/e^2}{1+\frac{z^2 p(1-p)/e^2}{N}} = \frac{z^2 p(1-p)N}{z^2 p(1-p)+ Ne^2}} \quad (9)$$

Where *z* presents the critical value of confidence level and *p* estimates the respondent distribution, the most conservative assumption is 50% for normal distribution. As the composition of that formula, the basic requirements are those two entities. This formula can be applicable if the research uses 95 % degree of confidence level because z value equals to 1.96 (Tejada and Punzalan, 2012). Here is the calculation of sample size:

$$n = \frac{1.96^2 0.5(1-0.5)/0.05^2}{1+\frac{1.96^2 0.\frac{5(1-0.5)}{0}.05^2}{3{,}022{,}481}}$$

$$n = 383.9998 \approx 384\ samples$$

By using standard error 5% and *z*-value 1.96 of normal distribution with respondent distribution probability (*p*) 50%, the result of sample size calculation which comes from 3,022,481 number of population is 384 samples.

3.4 Data Collection Stage

After initial stage, the next stage is data collection and processing based on the problem identification in the first chapter. It is about society willingness to

change private mobility access and to pay monorail and tram which affects the feasibility of SMART project. This stage consists of several steps in below:

3.4.1 Data Requirement

In this stage, the researcher does data collection to support the final project assessment. The needed data of society willingness and readiness for SMART project are:

1. Location target and survey number

   This data consists of regions in Surabaya and their population, and then the needed sample of each region is calculated.

2. Respondents Characteristics

   The outcome of this data represents the respondent characteristics as the observation object and effect of willingness to pay research.

3. Readiness and Willingness to pay

   The outcome of this data is used to analyze the social readiness and willingness to pay level. Each readiness and willingness will be shown the effect of each attributes.

Those data are collected by direct observation and survey. The secondary data are collected by other resources, such as statistic data, interviewing to related institutions.

3.4.2 Survey Design

Questionnaire design used to measure social willingness and maximum cost of monorail and tram is divided into several parts. It has four parts:

a. Respondent Private Data

   Willingness to pay research about monorail and tram has certain respondent characteristics. It is necessary to make the questionnaire content. Socio-demographic questions aims to serve the subjectivity probability in responding the questionnaire. Here is the target of respondent characteristics:

Table 3.1 Respondent Private Data Attribute

Attribute	Choices
Socio-demography	Employees
	PNS
	Student
	Household
Gender	Male
	Female
Income	Low (< 3 millions)
	Medium (3-7.5 millions)
	High (7.5-15 millions)
	Very high (> 15 millions)
Owned Car Number	1
	2
	3
	>3
Owned Motorcycle Number	1
	2
	3
	>3
Fuels Consumption	< 2 liter/week
	2 liter- 10 liter/week
	11-25 liter/week
	> 25 liter/week
Purpose of trip	Working
	Study
	Shopping
	Lifestyle/ Vacation
Frequency of using transportation	Every day
	3-4 times/ week
	once a week
	< once a week
Distance of using transportation per day	

b. Readiness to use monorail and tram

This part consists of several readiness attributes to use MRT, monorail and tram, which will be asked to respondent. Respondent will chose the readiness ranking among 1 until 5 scales. The type of attributes has been explained in the previous chapter, literature review.

c. Willingness to shift monorail and tram

This questionnaire part consists of questions with "Yes" or "No" answer, which is used to analyze the social willingness to shift to monorail and tram.

d. Willingness to pay

This part is divided into two parts, willingness to pay without price and willingness to pay based on price. Willingness to pay without price consists of several options about monorail and tram facilities, so respondent will choose the preferred one. Meanwhile, willingness to pay based on price consists of several questions about the respondent ability to pay the cost range of MRT ticket. When monorail and tram have the same type of transportation mode, the price questionnaire becomes one part. It was assumed that monorail and tram have the same cost because there is no specific transportation attributes influencing the WTP based on price. The survey design of this research was approved by BAPPEKO Surabaya. The questionnaire design of readiness and willingness to pay of SMART monorail and tram is attached in Appendix A.

3.4.3 Questionnaire Distribution

The questionnaires are distributed to the research respondent target in 31 regions of Surabaya. Based on the calculation result, the distributed questionnaire are 384 samples. Like population number in each region, the number of sample size is also different. The sample size of each region comes from the population proportion of total Surabaya population multiplied by the result of sample size. The questionnaires are distributed by using direct interview. Before answering the questionnaire, respondent should know about MRT, monorail and tram. The result of questionnaire distribution in Surabaya population is recapped into Appendix B.

3.4.4 Questionnaire Recapitulation

After all of questionnaires have been collected, the questionnaire data is recapped and tabulated. Then, the data is tested for validity and reliability.

3.5 Data Processing Stage

After the needed data have been collected, then they are processed by the best selected method to solve the main problem in this research. The result of data processing will be analyzed to find the value of society willingness and readiness to pay MRT, monorail and tram.

3.5.1 Validity dan Reliability Test

Validity test is used to test the data validity of distributed questionnaire. Validity test uses SPSS 16 focused on product moment of Pearson Correlation of each variable. If the value is higher than significant level, the data will be valid. Reliability test is used to test the respondent consistency level in answering the questionnaire by using Reliability Statistics of Cronbrach‟s Alpha. Validity and reliability test are processed before the main data processing, such as willingness calculation.

3.5.2 Sample Characteristics Description

Sample characteristics description comes from the result of questionnaire recapitulation in statistics. It is used to represent the social-economic condition of Surabaya population. It will be analyzed what is the effect to willingness to pay and MRT cost determination. The purpose is to analyze the social heterogeneity to the willingness to pay motivation and ticket cost determination.

3.5.3 Readiness of using monorail and tram

Readiness of using monorail and tram measurement comes from the questionnaire recapitulation. This recapitulation is used to show the social readiness level of using MRT based on several proposed reasons and motives.

3.5.4 Willingness to Shift

Willingness to shift to use MRT measurement also comes from the questionnaire recapitulation. This data consists of willingness to shift or not comparison of several proposed factors.

3.5.5 Willingness to Pay Calculation

Willingness to pay calculation also comes from the questionnaire recapitulation. The selected method is Random Utility Model/ Logistics Regression. This method is used to evaluate the influences of attributes to willingness to pay. Whereas, the monorail and tram cost determination uses the total of questionnaire recapitulation.

3.6 Analysis and Discussion Stage

This part is the analysis and discussion process of data processing in the previous stage. It divided into several parts:

- Readiness ranking scale

  The result of ranking process for readiness questionnaire is analyzed based on the gap of agreeing and refusing new transportation mode, monorail and tram. This analysis focuses in gender, income, and daily transportation type factor.

- Willingness to shift using statistics summary

  This result conducts to the variability demand of consumer or user that they are willing to shift or not monorail and tram. This analysis focuses in daily transportation type factor.

- Willingness to pay price and option using RUM

  This analysis is used to evaluate the result of social willingness to pay, the influenced factors and attributes, especially transportation option. This analysis divided into two parts.

- Monorail and Tram cost recommendation

  This analysis focuses on the result of cost recommendation will affect the value of new transportation mode in society considering the current socioeconomic sight.

3.7 Conclusion and Recommendation

The last stage of this research is doing conclusion and recommendation. The conclusion will answer the objectives or target of this research and give

recommendation for Surabaya government to make the best decision of implementing SMART project.

CHAPTER 4
DATA COLLECTION AND PROCESSING

This chapter explains two parts. First, it consists of data collection which consists of the result of collected data from survey questionnaire. Second, it contains data processing which explains how to process the collected data. Both of steps are used to preserve the information be clearly understanding. The result of this stage will be analyzed into the next chapter.

4.1 Data Collection

This stage is related with the method of collecting of the needed data for research. The collected data has two categories, primer data by direct interview, questionnaire, and secondary data by other sources which have been existed, such as government policy, internet, and brainstorming.

4.1.1 Data Requirement

The needed data of society willingness and readiness for SMART project are:

1. Location of monorail and tram track line

Boyorail has tracking line along 23 km with travel velocity 60 km/hour (Dinas Perhubungan Kota Surabaya, 2013). The tracking line of Boyorail is served into Tabel 4.1.

Table 4.1Boyorail Inter-Station Distance and Tracking Line

No.	From	To	Distance (Km)
TB1	Sentra Bulak	-	0.00
TB2	Sentra Bulak	THP Kenjeran	2.10
TB3	THP Kenjeran	Ken Park	1.61
TB4	Ken Park	Mulyosari Utara	0.60
TB5	Mulyosari Utara	Mulyosari Tengah (CentralPark)	0.71
TB6	Mulyosari Tengah (CentralPark)	Kejawan Putih Tambak	1.15
TB7	Kejawan Putih Tambak	Bundaran ITS	1.19
TB8	Bundaran ITS	Kertajaya Indah (GOR)	0.95

No.	From	To	Distance (Km)
TB9	Kertajaya Indah (GOR)	Manyar Kertoarjo (Samsat)	2.06
TB10	Manyar Kertoarjo (Samsat)	RSUD Dr. Sutomo	1.84
TB11	RSUD Dr. Sutomo	Stasiun Gubeng	0.92
TB12	Stasiun Gubeng	Taman Mukti Mulia	0.67
TB13	Taman Mukti Mulia	Keputran	1.67
TB14	Keputran	Jembatan BAT Ngagel	1.23
TB15	Jembatan BAT Ngagel	Terminal Joyoboyo	1.44
TB16	Terminal Joyoboyo	Mjd. Sungkono (Ciputra World)	2.29
TB17	Mjd. Sungkono (Ciputra World)	Mjd. Sungkono (Bundaran Tol)	1.37
TB18	Mjd. Sungkono (Bundaran Tol)	HR Mohammad (Giants)	1.71
TB19	HR Mohammad (Giants)	HR Mohammad (Patung Kuda)	0.80
TB20	HR Mohammad (Patung Kuda)	Darmo Golf Boulevard	1.30
TB21	Darmo Golf Boulevard	Pakuwon Trade Center	2.60

Surotrem has tracking line along 18.18 km with travel velocity 40 km/hour (Dinas Perhubungan Kota Surabaya, 2013). The tracking line of Surotrem is served into Tabel 4.2.

Table 4.2Surotrem Inter-Station Distance and Tracking Line

No.	From	To	Distance (Km)
SU1	Terminal Joyoboyo	-	0.00
SU2	Terminal Joyoboyo	Raya Darmo (Bungkul)	0.81
SU3	Raya Darmo (Bungkul)	Raya Darmo (Santa Maria)	0.79
SU4	Raya Darmo (Santa Maria)	Urip Sumoharjo	1.10
SU5	Urip Sumoharjo	Basuki Rachmad	0.63
SU6	Basuki Rachmad	Embong Malang	1.00
SU7	Embong Malang	Pasar Blauran	0.85
SU8	Pasar Blauran	Bubutan (Halo Surabaya)	0.55
SU9	Bubutan (Halo Surabaya)	Tugu Pahlawan	0.54
SU10	Tugu Pahlawan	Indrapura DPRD Jatim	0.58
SU11	Indrapura DPRD Jatim	Indrapura Parangkusuma	0.65
SU12	Indrapura Parangkusuma	Indrapura (Pertigaan Rajawali)	0.56
SU13	Indrapura (Pertigaan Rajawali)	Perak (Kerapu)	0.68
SU14	Perak (Kerapu)	Perak (Tanjung Sadari)	0.82
SU15	Perak (Tanjung Sadari)	Perak (Teluk Betung)	1.12
SU16	Perak (Teluk Betung)	Rajawali (Kalisosok)	3.04
SU17	Rajawali (Kalisosok)	Rajawali (Taman Jayengrono)	0.37

No.	From	To	Distance (Km)
SU18	Rajawali (Taman Jayengrono)	Veteran (BCA)	0.53
SU19	Veteran (BCA)	Tugu Pahlawan (Gubernur)	0.54
SU20	Tugu Pahlawan (Gubernuran)	Kramat Gantung	0.72
SU21	Kramat Gantung	Tunjungan	0.50
SU22	Tunjungan	Grahadi (Gub. Suryo)	1.12
SU23	Grahadi (Gub. Suryo)	Panglima Sudirman (Bambu Runcing)	0.68

2. Surabaya Population

This Surabaya population data becomes the reference of determining survey location and affecting the result of respondent characteristics. Surabaya has divided into five areas, center, east, west, north, and south. Each area has several regions. The total regions in Surabaya are 31. The data of Surabaya population is recapped into Appendix B.

4.1.2 Questionnaire Distribution

This data consists of regions in Surabaya and their population, and then the sample target of each region is calculated. Actually, the collected questionnaire is less than the sample target. So, the collected questionnaire is tested by normal distribution with 95% confidence level and z-test ±1.96. The result of calculation can represent the sample target with z-value is -0.594. The distribution of collected questionnaire is recapped into Appendix B.

4.1.3 Recapped Questionnaire Data

This part shows the result of survey process. This survey result consists of four types of information data. respondent data. readiness to use. willingness to shift. and willingness to pay. The recapped data is attached in Appendix C.

4.2 Data Processing

After the data was collected, the next stage is data processing. It is related to the way of calculating data. This stage consist of validity and reliability test, readiness ranking scale, willingness to shift, and willingness to pay.

4.2.1 Validity and Reliability Test

Validity test uses SPSS software. which aims to show the validity data of questionnaire. The inputted data comes from social readiness survey and socio-demography aspect of using monorail and tram.

4.2.1.1 Validity Test

Validity Test aims to know the validity of survey data from questionnaire distribution. It can be shown by the value of KMO and Bartlett‟s Test from SPSS result. Here is the result of validity test for both social readiness and socio-demography aspect.

❖ Socio-demography Data

Here is the result of validity test of socio-demography aspect and predictor variables.

Table 4.3 KMO and Bartlett‟s Test Result

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.514
Bartlett's Test of Sphericity	Approx. Chi-Square	333.113
	df	21
	Sig.	.000

Table 4.4Validity Test Result of Socio-demographic

No.	Predictor Variables	R. Calculation	R. Table	Result
1	Gender	0.533	0.3	Valid
2	Job	0.521	0.3	Valid
3	Income	0.598	0.3	Valid
4	Daily Transporttation	0.509	0.3	Valid
5	BBM Consumption	0.476	0.3	Valid
6	BBM Types	0.480	0.3	Valid
7	Travel Distance	0.596	0.3	Valid

Based on KMO and Bartlett‟s test, the result of sampling adequacy value is 0.514. The standard of validity test is 0.3, it means the sampling adequacy is adequate. And the result of validity test comes from the value of anti-image correlation for each variable. For predictor variables, which have higher value

than R Table 0.3 are gender, job, income, daily transportation, BBM consumption, BBM type, and travel distance. As result, all predictor variables data are stated as Valid.

❖ Readiness Data

There are two parts of readiness data for monorail and tram. Here is the result of validity test of social readiness data and predictor variables for monorail.

Table 4.5KMO and Bartlett‟s Test Result for Monorail

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.831
Bartlett's Test of Sphericity	Approx. Chi-Square	979.491
	df	36
	Sig.	.000

Table 4.6Validity Test Result for Monorail

No.	Predictor Variables	R. Calculation	R. Table	Result
1	Reduce Private Transportation	0.846	0.3	Valid
2	Station Distance	0.852	0.3	Valid
3	Government Center	0.885	0.3	Valid
4	Education Center	0.868	0.3	Valid
5	Shopping Center	0.751	0.3	Valid
6	Vacation Center	0.816	0.3	Valid
7	Congestion	0.851	0.3	Valid
8	Pollution	0.816	0.3	Valid
9	Accident	0.821	0.3	Valid

Based on KMO and Bartlett‟s test, the result of sampling adequacy value is 0.831. The standard of validity test is 0.3, it means the sampling adequacy is adequate. Predictor variables of readiness data which have higher value than R Table 0.3 are reduce private transportation, station distance, government center, education center, shopping center, vacation center, congestion, pollution, and accident. Finally, all predictor variables data are stated as Valid.

And here is the result of validity test of social readiness data and predictor variables for tram.

Table 4.7 KMO and Bartlett‟s Test Result for Tram

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.828
Bartlett's Test of Sphericity	Approx. Chi-Square	1.169E3
	df	36
	Sig.	.000

Table 4.8Validity Test Result for Tram

No.	Predictor Variables	R. Calculation	R. Table	Result
1	Reduce Private Transportation	0.900	0.3	Valid
2	Station Distance	0.857	0.3	Valid
3	Government Center	0.854	0.3	Valid
4	Education Center	0.893	0.3	Valid
5	Shopping Center	0.817	0.3	Valid
6	Vacation Center	0.819	0.3	Valid
7	Congestion	0.767	0.3	Valid
8	Pollution	0.762	0.3	Valid
9	Accident	0.890	0.3	Valid

Based on KMO and Bartlett‟s test, the result of sampling adequacy value is 0.828. The standard of validity test is 0.3, it means the sampling adequacy is adequate. Predictor variables of readiness data which have higher value than R Table 0.3 are also reduce private transportation, station distance, government center, education center, shopping center, vacation center, congestion, pollution, and accident. So, all predictor variables data are stated as Valid.

4.2.1.2 Reliability Test

Reliability Test aims to test the respondent consistency level in answering the questionnaire. The parameter of reliability test is the value of Cronbach‟s Alpha and Correlated Item-Total Correlation. Reliability test is also divided into two parts, socio-demography and social readiness data.

- Socio-demography Data

Here is the result of reliability test of socio-demography aspect and predictor variables.

Table 4.9 Cronbach‟s Alpha for Socio-demography

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.312	.281	7

Table 4.10 Reliability Test Result for Socio-demography

No.	Predictor Variables	Corrected Item-Total Correlation
1	Gender	0.490
2	Job	0.479
3	Income	0.542
4	Daily Transporttation	0.277
5	BBM Consumption	0.468
6	BBM Types	0.572
7	Travel Distance	0.354

From running reliability test, the result of Cronbach‟s Alpha for socio-demography aspect is 0.312 which has higher than the standard of R-Value 0.279. It means that the result of socio-demography survey is reliable. Predictor variables of socio-demography data which has highest value of corrected item-total correlation is 0.572, BBM types. The lowest value of corrected item-total correlation is 0.277, income. This value shows that the distribution of answering income choices was dominant in one type.

❖ Readiness Data

In this reliability test, there are also two parts of readiness data for monorail and tram. Here is the result of reliability test of social readiness data and predictor variables for monorail.

Table 4.11Cronbach‟s Alpha for Monorail

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.846	.857	9

Table 4.12 Reliability Test Result for Monorail

No.	Predictor Variables	Corrected Item-Total Correlation
1	Reduce Private Transportation	0.540
2	Station Distance	0.472
3	Government Center	0.480
4	Education Center	0.613
5	Shopping Center	0.549
6	Vacation Center	0.575
7	Congestion	0.713
8	Pollution	0.641
9	Accident	0.599

In Table 4.x, the result of Cronbach‟s Alpha for social readiness for monorail is 0.846 which has higher than the standard of R-Value 0.279. It means that the result of social readiness for monorail survey is reliable. Predictor variables of social readiness for monorail data which has highest value of corrected item-total correlation is 0.713, congestion. The lowest value of corrected item-total correlation is 0.472, station distance. But, this value is still in the reliable position.

And here is the result of reliability test of social readiness data and predictor variables for tram.

Table 4.13 Cronbach‟s Alpha for Tram

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.862	.872	9

Table 4.14 Reliability Test Result for Tram

No.	Predictor Variables	Corrected Item-Total Correlation
1	Reduce Private Transportation	0.580
2	Station Distance	0.470
3	Government Center	0.508
4	Education Center	0.592
5	Shopping Center	0.640
6	Vacation Center	0.631
7	Congestion	0.696
8	Pollution	0.704
9	Accident	0.618

In Table 4.x, the result of Cronbach‟s Alpha for social readiness for tram is 0.862 which also has higher than the standard of R-Value 0.279. As same as monorail, the result of social readiness for monorail survey is reliable. Predictor variables of social readiness for monorail data which has highest value of corrected item-total correlation is 0.704, pollution. The lowest value of corrected item-total correlation is 0.470, station distance.

4.2.2 Sample Characteristics Description

This part shows the characteristics of Surabaya population in socio-economics aspects. The summary of survey respondents is divided into five areas; center, west, east, north, and south Surabaya. This survey focuses in those areas because the plan route of MRT was through over five areas of Surabaya. Survey respondents are presented in percentages of Surabaya population. Here is the summary of sample characteristics description.

Table 4.15 Sample Characteristics Description of Surabaya City

Attributes	Center Surabaya		East Surabaya		West Surabaya		North Surabaya		South Surabaya	
	Survey	Proportion	Survey	Proportion	Survey	Proportion	Survey	Proportion	Survey	Proportion
Occupation										
Stated Employees	4	1,5%	8	3,0%	9	3,4%	4	1,5%	7	2,7%
Enterprise	4	1,5%	17	6,4%	15	5,7%	16	6,1%	17	6,4%
Students	10	3,8%	22	8,3%	20	7,6%	24	9,1%	23	8,7%
Household	6	2,3%	20	7,6%	13	4,9%	6	2,3%	19	7,2%
Gender										
Male	11	4,2%	28	10,6%	30	11,4%	29	11,0%	31	11,7%
Female	13	4,9%	39	14,8%	27	10,2%	21	8,0%	35	13,3%
Income										
Low (< 3 millions)	19	7,2%	50	18,9%	31	11,7%	42	15,9%	47	17,8%
Medium (3 - 7.5 mill	5	1,9%	14	5,3%	19	7,2%	8	3,0%	18	6,8%
High (7.5 - 15 millions)			2	0,8%	6	2,3%				
Very high (> 15 millions)			1	0,4%	1	0,4%			1	0,4%
Owned Car Number										
0	23	8,7%	50	18,9%	41	15,5%	47	17,8%	55	20,8%
1	1	0,4%	14	5,3%	16	6,1%	3	1,1%	10	3,8%
2			2	0,8%						
3			1	0,4%					1	0,4%
Owned Motorcycle Number										
0					11	4,2%	3	1,1%	8	3,0%
1	20	7,6%	52	19,7%	33	12,5%	44	16,7%	48	18,2%
2	4	1,5%	9	3,4%	12	4,5%	2	0,8%	9	3,4%
3			6	2,3%			1	0,4%	1	0,4%
Frequency										
Every day	21	8,0%	55	20,8%	50	18,9%	42	15,9%	56	21,2%
3-4 times/ week	2	0,8%	6	2,3%	6	2,3%	8	3,0%	7	2,7%
Once a week	1	0,4%	4	1,5%	1	0,4%			2	0,8%
< once a week			2	0,8%					1	0,4%
Purpose of trip										
Working	12	4,5%	29	11,0%	28	10,6%	18	6,8%	28	10,6%
Study	9	3,4%	20	7,6%	18	6,8%	23	8,7%	24	9,1%
Shopping	3	1,1%	15	5,7%	11	4,2%	9	3,4%	10	3,8%
Lifestyle/ Vacation			3	1,1%					4	1,5%
Daily Transportation Type										
Car			11	4,2%	10	3,8%	2	0,8%	5	1,9%
Motorcylce	22	8,3%	56	21,2%	44	16,7%	45	17,0%	55	20,8%
Public Transportatio	2	0,8%			3	1,1%	3	1,1%		
Bike/walking									6	2,3%
Fuels Consumption										
< 2 liter/week	5	1,9%	12	4,5%	5	1,9%	6	2,3%	3	1,1%
2 liter- 10 liter/week	16	6,1%	40	15,2%	43	16,3%	38	14,4%	52	19,7%
11-25 liter/week	3	1,1%	8	3,0%	7	2,7%	3	1,1%	4	1,5%
> 25 liter/week			6	2,3%					2	0,8%
Type of BBM Consumption										
Premium	20	7,6%	52	19,7%	45	17,0%	38	14,4%	50	18,9%
Pertamax	4	1,5%	11	4,2%	8	3,0%	9	3,4%	11	4,2%
Solar			4	1,5%	4	1,5%				
BBG										
Daily Transporting Distance										
< 10 km	12	4,5%	24	9,1%	10	3,8%	15	5,7%	18	6,8%
10- 29.9 km	11	4,2%	26	9,8%	30	11,4%	26	9,8%	34	12,9%
30 - 60 km	1	0,4%	12	4,5%	17	6,4%	9	3,4%	13	4,9%
> 60 km			3	1,1%						
N	**24**		67		57		50		66	264

In achieving the study‟s objective, 264 questionnaires were distributed to five areas of Surabaya. Each area has sample number based on its population density. The high population density is located in east and south Surabaya which have 67 and 66 samples. Generally, people who use transportation are students and employees (PNS and Enterprise), especially using private transportation (car and motorcycle). From economics sight, Surabaya population is mostly located in

low-medium income, up to 7.5 millions. But, few of them are located in high income, east and west Surabaya. It shows that the condition of both areas have faster socioeconomics acceleration than other areas, a lot of residence, mall, enterprise, and etc. In owned private transportation sight, east Surabaya has high number of owned car than other areas because mostly areas have preferred to invest motorcycle type as private transportation. Surabaya society is dominant to use motorcycle as daily transportation because of efficient in BBM consumption, small space, and easy to go anywhere. As result, the Surabaya society mostly consumes BBM only between 2-10 liters per week. It indicates that motorcycle user is higher than car user. Most of people who consume BBM higher than 10 liters per week are car user.

Based on BBM type, the subsidized BBM (premium, pertamax, and solar) still becomes the priority choice of Surabaya society, so no one consumes BBG type. The using of transportation is mainly for working and schooling which has high travel frequency for everyday. Some of them use transportation for shopping and vacation/lifestyle with less travel frequency than working and study. People do those activities for weekend or certain season, such school holiday or refreshing motives.

In daily transporting distance sight, all areas have travel distance ranges between 10 and 29.99 km. It means that most of Surabaya people have destination location over their living area. For example, there are several people that live in South Surabaya have worked or studied in Center Surabaya.

4.2.3 Readiness of Use Ranking Scale

This part shows the result of measuring social readiness about Surabaya Mass Rapit Transit, especially monorail and tram. It shows the percentage of individuals who willing to use monorail and tram.

a. Whole Data

This whole data shows the result of social readiness level of using monorail and tram in each proposed factor. There are three readiness factors which are:

❖ Change to monorail and tram

In this factor, there are two parts, reduce private transportation and station distance. Here is the result of the readiness to use monorail and tram transportation for change to monorail and tram factor.

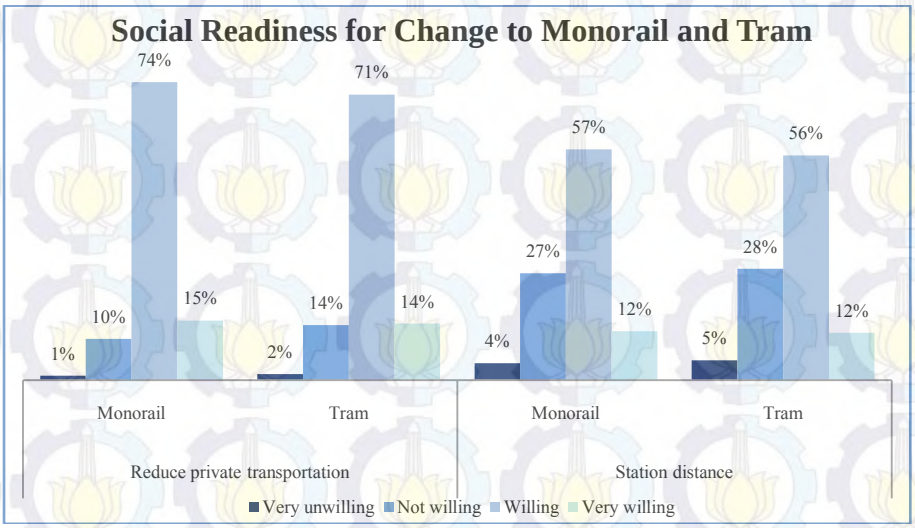


Figure 4.1Social Readiness level (Change to Monorail and Tram)

Figure 4.1 shows that the readiness level for change to monorail and tram factor is more than 50 %. The highest readiness level for change to monorail and tram factor is reducing private transportation to use monorail, which reaches 74% willing and 15 % strongly willing. In other hand, readiness level for station distance 1 km sub factor has lower value than reducing private transportation. For monorail, there are totally 31% refusing to walk 1km into station and 32 % for tram.

❖ Travel destination

There are four destination that has been offered, government center, education center, shopping center, and vacation center. Here is the result of readiness level of Surabaya society to use monorail and tram for travel destination factor.

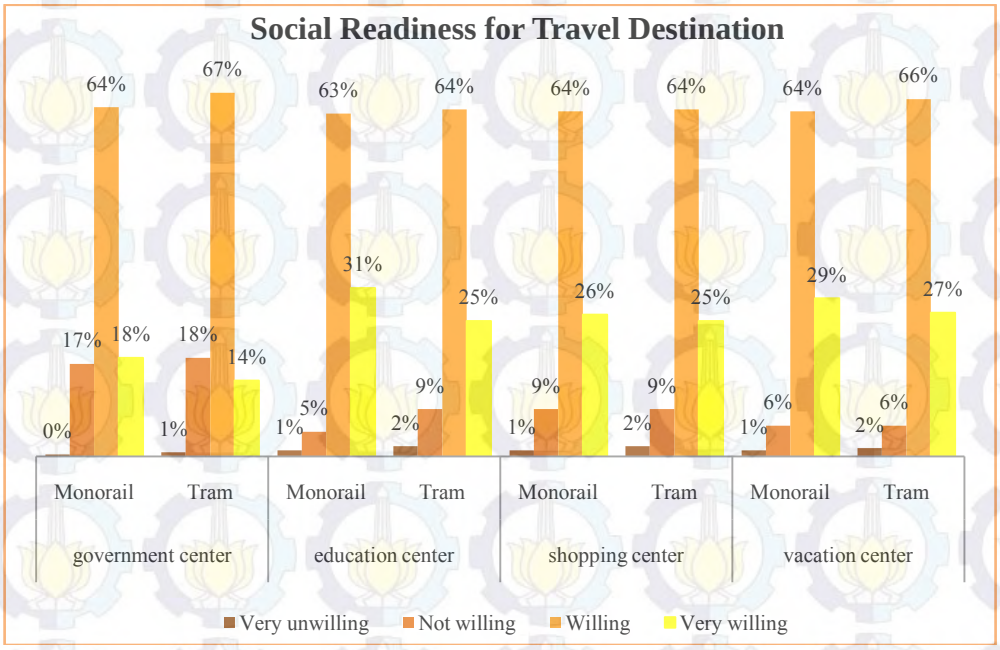


Figure 4.2 Social Readiness Level (Travel Destination)

Figure 4.2 shows that the readiness level for travel destination factor is also more than 50 % for all four destinations. Overall, both monorail and tram have not significant different of willingness percentage. The highest readiness level for travel distance factor is education center destination by using monorail, which totally reaches 94 % willing. For using tram, it totally reaches 89 %. Otherwise, readiness level for government center destination for tram sub factor has the highest value of refusing percentage in all of travel destination sub factors, which reaches 19 %.

❖ Environmental effect

Environmental effect factor is divided into several sub factors, congestion, pollution, and accident. Here is the result of readiness level of Surabaya society to use monorail and tram for environmental effect factor.

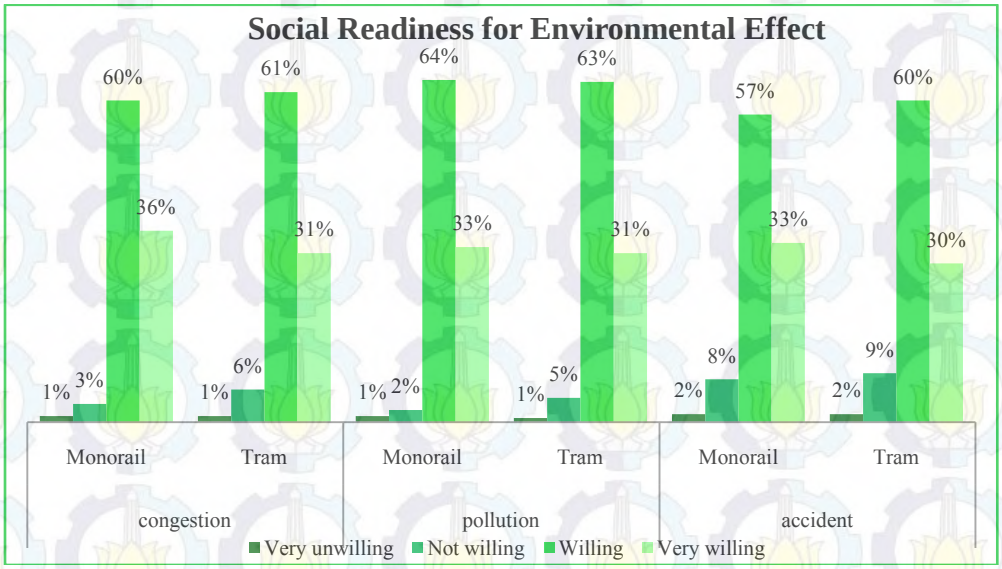


Figure 4.3 Social Readiness Level (Environmental Effect)

Figure 4.3 shows that the readiness level for environmental effect factor is also more than 50 % for all three sub factors. Like as travel destination, both monorail and tram have not significant different of willingness percentage. The highest readiness level for environmental effect factor is pollution effect by monorail, which totally reaches 97 % willing. For using tram, it totally reaches 94 %. Other side, readiness level for accident effect for tram sub factor has the highest value of refusing percentage in all of environmental effect sub factors, which reaches 11 %. For monorail, it is less 1 % than tram.

b. Socioeconomic Classification

This socioeconomic classification shows the social readiness level of using monorail and tram categorized by several socioeconomic aspects. There are three concerned aspects which are:

❖ Gender Aspect

There are two parts of readiness level of monorail and tram based on gender aspect. First, here is the readiness level for female sight.

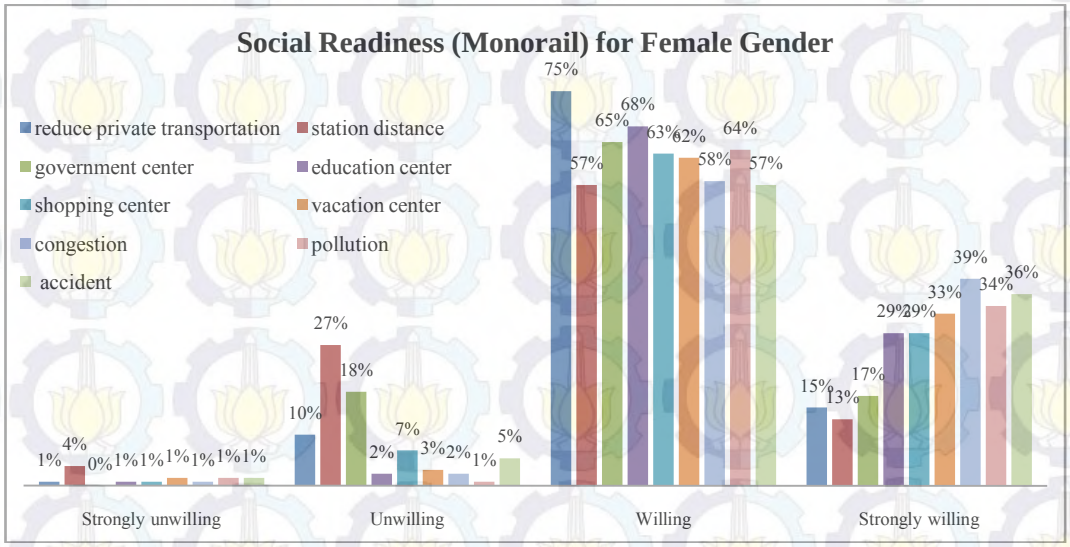


Figure 4.4 Social Readiness (Monorail) for Female Gender

Generally, female gender mostly agrees to use monorail. The readiness level of environmental effect factor is higher than travel distance factor. The lowest readiness level comes from changing to monorail factor. The highest readiness level to use monorail is caused by pollution motive. But, there is significant value of refusing to use monorail which is caused by walking distance to monorail station. The refusing value reaches 31 %. By this figure, it can be concluded that female gender willing to use monorail in overall readiness factor. For other MRT transportation, here is the result of readiness level of tram based on female gender.

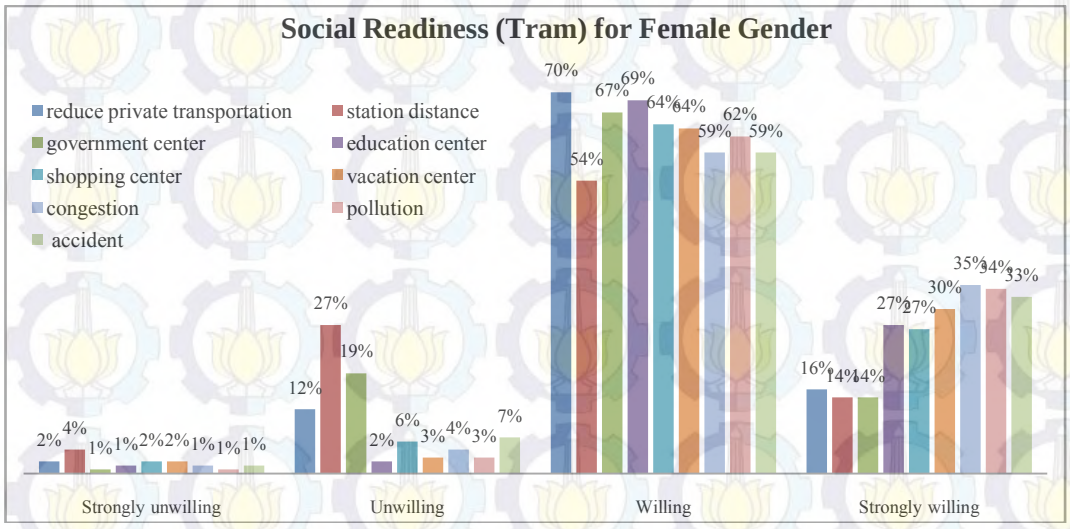


Figure 4.5 Social Readiness (Tram) for Female Gender

Generally, Figure 4.x shows that female gender mostly agrees to use tram. In this tram, the readiness level of environmental effect factor is lower than travel distance factor. The lowest readiness level comes from changing to tram factor. The highest readiness level to use tram is caused by travel distance motive to education center. Same as monorail, the significant value of refusing to use tram is also caused by walking distance to tram station. The refusing value reaches 31 %. So, it can be concluded that female gender willing to use tram in overall readiness factor.

And second, here is the readiness level for male sight.

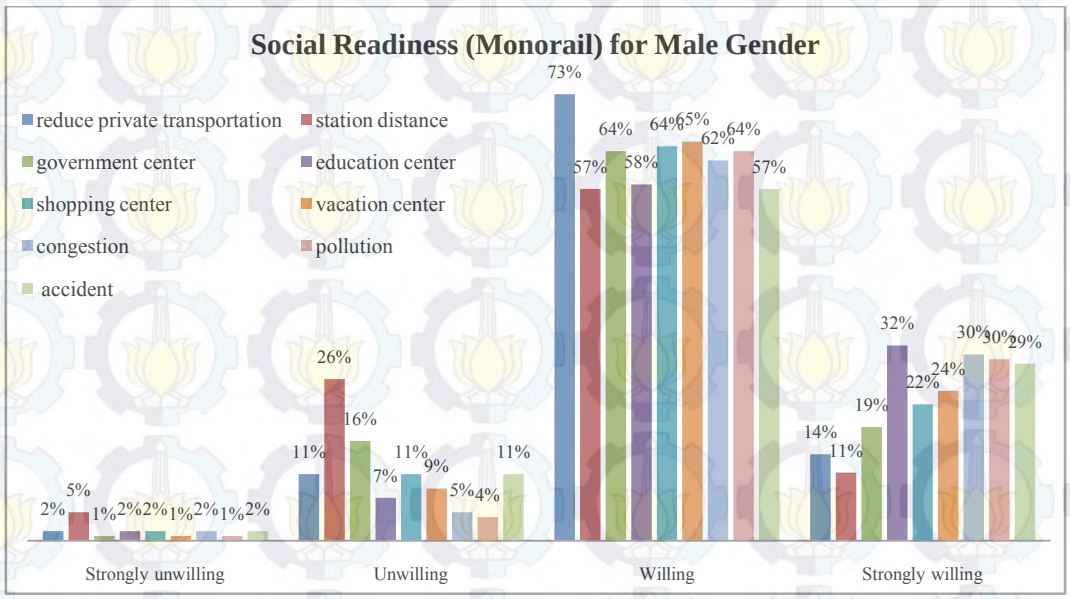


Figure 4.6 Social Readiness (Monorail) for Male Gender

Based on Figure 4.6, the result of readiness level for male gender mostly agrees to use monorail. From the comparison among three readiness factors, the readiness level of environmental effect factor is higher than travel distance factor. The lowest readiness level comes from changing to tram factor. The highest readiness level to use monorail is caused by pollution motive. Same as female gender, the significant value of refusing to use monorail is also caused by walking distance to monorail station. The refusing value reaches 31 %. As result, it can be concluded that male gender still willing to use tram in overall readiness factor.

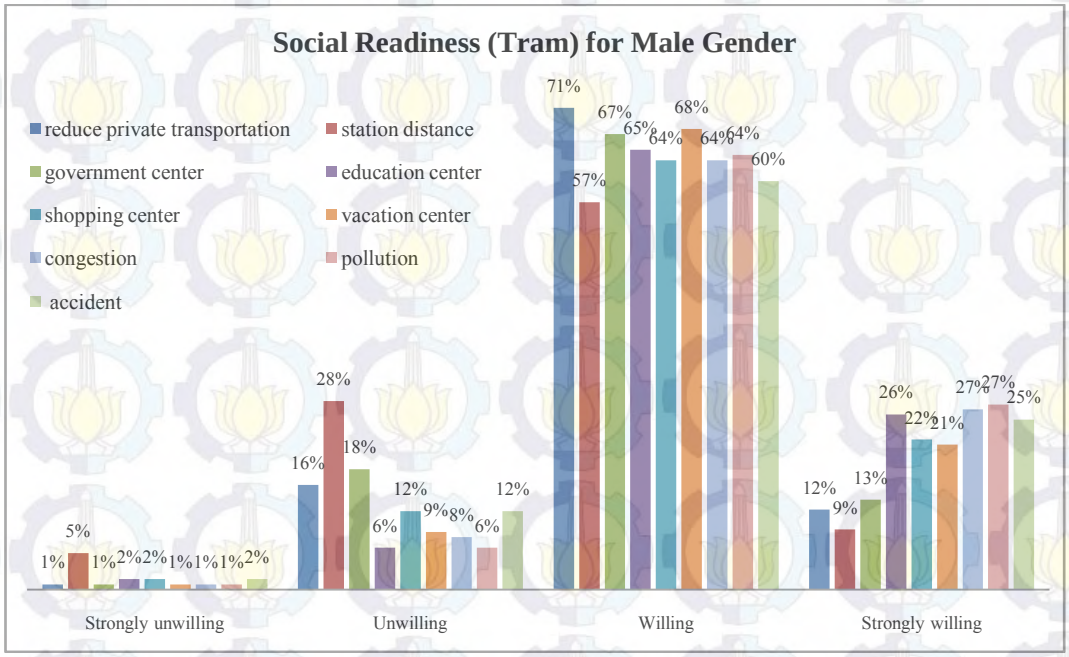


Figure 4.7 Social Readiness (Tram) for Male Gender

Figure 4.7 shows that the result of readiness level for male gender mostly agrees to use tram. From the comparison among three readiness factors, the readiness level of environmental effect factor is higher than travel distance factor. The lowest readiness level also comes from changing to tram factor. The highest readiness level to use tram is caused by pollution motive which reaches 93%. Same as female gender, the significant value of refusing to use tram is also caused by walking distance to tram station. The refusing value reaches 33 %. So, it can be concluded that male gender still willing to use tram in overall readiness factor.

❖ Income Aspect

This income aspect is categorized into four levels, low (< 3 millions), medium (3-7.5 millions), high (7.5-15 millions), and very high (>15 millions). Here is the result of readiness level of Surabaya society based on income aspect.

Table 4.16 Readiness Level Based on Income Aspect

	Monorail				Tram				
	Strongly unwilling	Unwilling	Willing	Strongly willing	Strongly unwilling	Unwilling	Willing	Strongly willing	Total
Income < 3,000,000 IDR									
reduce private transportation	1	19	138	31	3	25	130	31	
station distance	7	55	103	24	9	57	97	26	
government center	0	37	117	35	1	37	121	30	
education center	0	9	116	64	2	8	120	59	
shopping center	1	19	115	53	3	19	113	53	189
vacation center	1	11	120	56	2	11	122	53	
congestion	2	5	100	82	2	10	103	74	
pollution	2	3	110	73	1	8	107	73	
accident	3	15	97	74	3	18	100	68	
Income 3,000,000 -7,500,000 IDR									
reduce private transportation	1	8	48	7	1	10	49	4	
station distance	4	15	38	7	4	16	39	5	
government center	1	8	43	12	1	9	47	7	
education center	2	3	45	14	2	3	50	9	
shopping center	2	4	43	15	2	3	46	13	64
vacation center	2	4	41	17	2	4	44	14	
congestion	1	3	51	9	1	4	51	8	
pollution	1	2	52	9	1	3	51	9	
accident	1	5	47	11	1	5	49	9	
Income 7,500,000-15,000,000 IDR									
reduce private transportation	1	0	7	0	0	1	6	1	
station distance	0	0	7	1	0	0	8	0	
government center	0	0	7	1	0	2	6	0	
education center	1	0	5	2	0	0	6	2	
shopping center	0	0	7	1	0	1	7	0	8
vacation center	0	0	6	2	0	0	7	1	
congestion	0	1	6	1	0	2	5	1	
pollution	0	1	5	2	0	1	6	1	
accident	0	1	5	2	0	1	6	1	
Income >15,000,000 IDR									
reduce private transportation	0	0	2	1	0	0	2	1	
station distance	0	0	3	0	0	0	3	0	
government center	0	0	3	0	0	0	3	0	
education center	0	0	1	2	0	0	1	2	
shopping center	0	0	3	0	0	0	3	0	3
vacation center	0	0	1	2	0	0	1	2	
congestion	0	0	1	2	0	0	3	0	
pollution	0	0	1	2	0	0	3	0	
accident	0	0	2	1	0	0	3	0	

Table 4.16 shows the number of respondent who willing to use monorail and tram categorized into several income levels. In the first income level, the readiness level for monorail has higher value than tram. It is shown by the different number of unwillingness in tram, specifically in reducing private transportation, station distance, pollution, congestion, and accident factor. Similarly, the readiness level for monorail in the medium income also has higher value than tram. Pollution motive still becomes the highest priority of respondent to use MRT transportation. In both of income level, environmental effect factor becomes the main priority of respondent uses monorail and tram. For the third income level, the number of unwilling respondent is very small. There is no respondent who refuses to use monorail and tram. Overall, the number willing choice is higher than unwilling which means that survey respondent agrees to use MRT transportation.

❖ Daily Transportation Aspect

This part is divided into three types, for car user, motorcycle user, and other transportation user. Here is the result of readiness level of Surabaya society based on daily transportation type aspect.

Table 4.17 Readiness Level for Car User

	Monorail				Tram				
	Strongly unwilling	Unwilling	Willing	Strongly willing	Strongly unwilling	Unwilling	Willing	Strongly willing	Total
				Car					
reduce private transportation	0	5	17	5	1	6	15	5	
station distance	1	4	17	5	1	5	16	5	
government center	0	3	17	7	0	3	18	6	
education center	0	1	17	9	0	0	18	9	
shopping center	0	3	16	8	1	1	16	9	27
vacation center	0	1	14	12	0	0	16	11	
congestion	0	0	17	10	0	0	19	8	
pollution	0	0	17	10	0	1	18	8	
accident	0	1	16	10	1	1	16	9	

From the result of Table 4.17, the number of willing respondent is higher than that of the unwilling. Same as the result of other socioeconomics aspect, the readiness level of using monorail is higher than tram. The environmental effect becomes the highest priority for respondent to use monorail and tram, which is shown by the small number of unwilling. In other hand, the high refusing number are reducing private transportation and walking distance to station.

Table 4.18 Readiness Level for Motorcycle User

	Monorail				Tram				
	Strongly unwilling	Unwilling	Willing	Strongly willing	Strongly unwilling	Unwilling	Willing	Strongly willing	Total
				Motorcycle					
reduce private transportation	3	22	166	33	3	30	160	31	
station distance	10	63	126	25	11	65	124	24	
government center	1	38	144	41	2	40	151	31	
education center	3	10	139	72	4	10	147	63	
shopping center	3	19	143	58	4	21	145	53	224
vacation center	3	13	145	62	4	14	149	56	
congestion	3	9	132	80	3	16	134	71	
pollution	3	6	141	73	2	11	141	70	
accident	4	20	126	74	3	23	133	65	

Table 4.18 shows that the number of willing respondent for motorcycle is also higher than that of the unwilling. Same as car user, the readiness level of using monorail is higher than tram. The environmental effect also becomes

the highest priority for respondent to use monorail and tram, which is shown by the small number of unwilling. In other hand, the significant result of refusing number is walking distance to station. There are 73 respondents for monorail and 77 respondents for tram who unwilling.

Table 4.19 Readiness Level for Other Transportation Types User

	Monorail				Tram				
	Strongly unwilling	Unwilling	Willing	Strongly willing	Strongly unwilling	Unwilling	Willing	Strongly willing	Total
Others (Walking, Bicycling, Public Transportation)									
reduce private transportation	0	0	12	1	0	0	12	1	
station distance	0	3	8	2	1	3	7	2	
government center	0	4	9	0	0	5	8	0	
education center	0	1	11	1	0	1	12	0	
shopping center	0	1	9	3	0	1	8	4	13
vacation center	0	1	9	3	0	1	9	3	
congestion	0	0	9	4	0	0	9	4	
pollution	0	0	10	3	0	0	8	5	
accident	0	0	9	4	0	0	9	4	

Table 4.19 shows that the number of willing respondent for walking, bicycling, and public transportation is higher than that of the unwilling. Like as car and motorcycle user, the readiness level of using monorail is also higher than tram. The environmental effect factor becomes the highest priority for respondent to use monorail and tram, which is shown by no respondent unwilling to use monorail and tram. Otherwise, the significant refusing number is travel distance factor to government center.

4.2.4 Willingness to Shift (WTS)

This part shows the result of social willingness to shift into monorail and tram with several proposed motives. The parameter of valuating those reason comes user or consumer demand. Here are the several potential motives of using monorail and tram.

- Walking distance motives

Here is the willingness to shift based on walking distance motive.

Table 4.20 Willingness to Shift of Walking Distance Motive

Willingness to shift of walking distance motive					
	< 0.3 km	0.3- 0.5 km	0.5 -1 km	> 1 km	Total
YES	14	73	106	18	211
NO					53
RESPONDENT					264

Based Table 4.20, there are 211 of respondents who willing to shift for walking distance motive. Most of people willing to shift to monorail and tram with walking distance to station less than 1 km. There are 18 respondents willing to shift with more than 1 km of walking. The highest willingness to shift percentage is around 0.5 until 1 km.

❖ Tolerance of bus feeder time

Here is the willingness to shift based on tolerance of bus feeder time.

Table 4.21 Willingness to Shift of Using Bus Feeder

	Willingness to shift of using bus feeder				
	< 5 min	5 -10 min	11-20 min	> 20 min	Total
YES	4	118	61	6	189
NO					75
RESPONDENT					264

Table 4.21 shows that there are 189 respondents who willing to shift of using bus feeder motive. Most of people willing to shift to monorail and tram with having tolerance of bus feeder less than 20 minutes. There are only 6 respondents who willing to shift with more than 20 minutes of waiting bus feeder. The highest willingness to shift of percentage is around 5 until 10 minutes.

❖ Parking lot cost

In this motive, there are two types of parking lots, per hour and per day. And here is the result of willingness to shift based parking lot cost motive.

Table 4.22 Willingness to Shift with Parking Lot Cost

	Willingness to shift with parking lot cost				
Per hour	<1000IDR	1000-1999IDR	2000-5000IDR	>5000IDR	Total
	83	85	65	2	
Per day	<10000IDR	10000-24999IDR	25000-50000IDR	>50000IDR	235
	151	72	9	3	
NO					29
RESPONDENT					264

Based Table 4.22, there are 235 respondents who say “YES” about willing to shift to monorail and tram for parking lot motive. A lot of people willing to

shift to monorail and tram with parking lot cost per hour less than 5000 IDR and per day less than 25000 IDR. There are only 2 respondents who willing to shift with more than 5000 IDR per hour and 12 with more than 25000 IDR per day.

- Transportation attributes

This motive is divided into several attributes. Here is the willingness to shift based on transportation attributes motive.

Table 4.23 Willingness to Shift with Transportation Attributes

Willingness to shift with transportation attributes							
payment system	Total	operation days	Total	Interarrival time	Total	Operation hours	Total
Manual	127	Monday-Friday	28	> 15 min	20	05.00-18.00	24
Card	137	seven days	236	15 min	104	05.00-22.00	122
				10 min	140	05.00-24.00	118
Total	264		264		264		264

Table 4.23 shows the willingness to shift to monorail and tram based on four types of transportation attribute. In payment system, the difference between manual and card system is 10 respondents. In operation days, there are significant number between Monday-Friday and seven days, which most of people choose seven days. In other attribute, the smallest number is more than 15 minutes for inter-arrival alternative and 5 AM-6 PM for operation hour alternative. For inter-arrival, people prefer to choose 15 minutes or 10 minutes and for operation hour, people prefer to choose 5 AM- 10 PM or 5 AM- 12 PM alternative.

4.2.5 Willingness to Pay

This part shows the data processing of willingness to pay of SMART Monorail and Tram. It is divided into two parts. willingness to pay option and willingness to pay based on price.

4.2.5.1 Willingness to Pay Option

WTP option produces the estimated WTP monorail and tram of each transportation attributes and socio-demographic factor. The result of WTP estimation for transportation attributes focuses in two types of MRT

transportation. Before calculating the estimated coefficient of WTP, the model specification of variables used by Logits Model is be determined. Here is the Specification of variables used in Logits Model.

Table 4.24 Specification of Variables used in the Logit Models

Name	Description
Fee	Maximum price of willingness to pay
0-1 Transportation attribute qualitative variables	
Days of Operation	
M-F	1 if transportation operates Monday through Friday; 0 otherwise
Seven Days	1 if transportation operates Monday through Sunday; 0 otherwise
Hours of Operation	
5 AM - 6 PM	1 if transportation operates 5 morning through 6 evening; 0 otherwise
5 AM - 10 PM	1 if transportation operates 5 morning through 10 night; 0 otherwise
5AM - 12 AM	1 if transportation operates 5 morning through 12 midnight; 0 otherwise
Inter-arrival Time	
> 15 min	1 if transportation operates at inter-arrival time > 15 min; 0 otherwise
15 min	1 if transportation operates at inter-arrival time every 15 min; 0 otherwise
10 min	1 if transportation operates at inter-arrival time every 10 min; 0 otherwise
Schedule of Operation	
Free	1 if transportation operates on free schedule; 0 otherwise
Scheduled	1 if transportation operates on time scheduled; 0 otherwise
Cleaness Service	
Enough	1 if transportation serves clean enough; 0 otherwise
Cleaned	1 if transportation always serves cleaned; 0 otherwise
Information Service	
Journey Map	1 if transportation serves journey map information; 0 otherwise
Delay Announcement	1 if transportation serves delay announcement information; 0 otherwise
Operator	1 if transportation serves an operator; 0 otherwise
Socio-demographic 0-1 qualitative	
Choose	1 if respondent chose a transportation option (Option 2 or Option 3) and 0 if respondent chose Option 1
Male	1 if the respondent was a male; 0 otherwise
Female	1 if the respondent was a female; 0 otherwise
Employees	1 if the respondent was an employee; 0 otherwise
Students	1 if the respondent was a student; 0 otherwise
Socio-demographic continuous variables	
Income_A	The respondent's income was below 3 millions (Rp/month)
Income_B	The respondent's income was between 3 - 7.499 millions (Rp/month)
Income_C	The respondent's income was between7.5 -15 millions (Rp/month)
Income_D	The respondent's income was above 15 millions (Rp/month)

There are two types of model specification, 0-1 or binary variables and quantitative value. The binary variables are transportation attributes and socio-demography qualitative value. The quantitative variables are fee and socio-demography continuous variables. After determining specification model of WTP, WTP parameter or coefficient must be processed. Minitab shows random utility model result by using logistic regression of each attribute parameter. Here the result of Estimated Logit Coefficients for two MRT types.

Table 4.25 Estimated Logit Coefficients for Two MRT Transportation

Attributes	Monorail		Tram	
	Coeff.	Std. Error	Coeff.	Std. Error
Fee	0.472255**	0.370037	0.522941**	0.344544
Operation Days				
Monday-Friday	-1.3873898	1.404833717	-1.30103	1.322219295
Seven Days	1.4048337	-1.404833717	1.3222193	-1.322219295
Operation Hours				
05.00 - 18.00	-1.4048337	1.404833717	-1.3222193	1.322219295
05.00 - 22.00	-0.1732434	0.200914843	-0.1962946	0.228882012
05.00 - 24.00	0.1732434	-0.132625565	0.1962946	-0.146128036
Inter-arrival				
> 15 min	0.0409836	-1.387389826	-1.30103	1.322219295
15 min	0.6710526	-0.173243416	-0.1962946	0.228882012
10 min	1.4901961	0.173243416	0.1962946	-0.146128036
Schedule				
Free	-1.3873898	1.404833717	-1.30103	1.322219295
Scheduled	1.4048337	-1.404833717	1.3222193	-1.322219295
Cleaness				
Enough	-1.3873898	1.404833717	-1.30103	1.322219295
Cleaned	1.4048337	-1.404833717	1.3222193	-1.322219295
Information Service				
Schedule	1.4048337	-0.132625565	1.3222193	-0.146128036
Operator	0.1732434	-1.404833717	0.146128	-1.322219295
Socio-demographic 0-1 qualitative				
Choose*Male	1.8027737	2.117271296	1.49485	0.031484794
Choose*Female	1.2007137	1.505149978	1.200714	0.061111111
Choose*Employees	0.1349957	-1.292809665	1.238882	0.078159364
Choose*Students	0.416309	-1.685741739	1.50515	0.030651341
Socio-demographic continuous variables				
Choose*Income_A	1.4149733**	-1.564835083	1.30103**	0.04929972
Choose*Income_B	1.3082086**	-1.30820858	0.148402**	0.047413793
Choose*Income_C	0.0001184*	1.505149978	-1.50515*	1.505149978
Choose*Income_D	4.354E-05*	1.939519253	-1.93952*	1.939519253

** Significant at the 5% level
* Significant at the 1% level

The result shows that there is no significant value among transportation attributes. Some of quantitative variables have significant level in 5% and 1 %. After getting WTP parameter of each transportation attribute, the positive WTP estimation can be calculated by dividing the parameter of each attributes by cost parameter. Here is the example calculation of positive WTP estimation for Monday-Friday of monorail.

$$WTP_k = -\frac{\beta_k}{\beta_s} = -\left(\frac{-1.3873898}{0.472225}\right) = 2.937798$$

$$percent = \left(1 - \varphi\left(-\frac{\beta_k}{\beta_s}\right)\right).100 = \left(1 - \varphi(2.937798)\right).100 = 0.2\%$$

The result of estimated positive and percentage of positive willingness to pay calculation for monorail and tram will be shown in the next chapter.

4.5.2.2 Willingness to Pay Based on Price

WTP based on price produces the percentage of individuals who willing to pay the monorail and tram in certain price. This process is used to decide the cost recommendation of MRT considered to the result of percentage of positive WTP and the total demand of using MRT transportation. Here is the result of positive WTP based on price served in Figure 4.8.

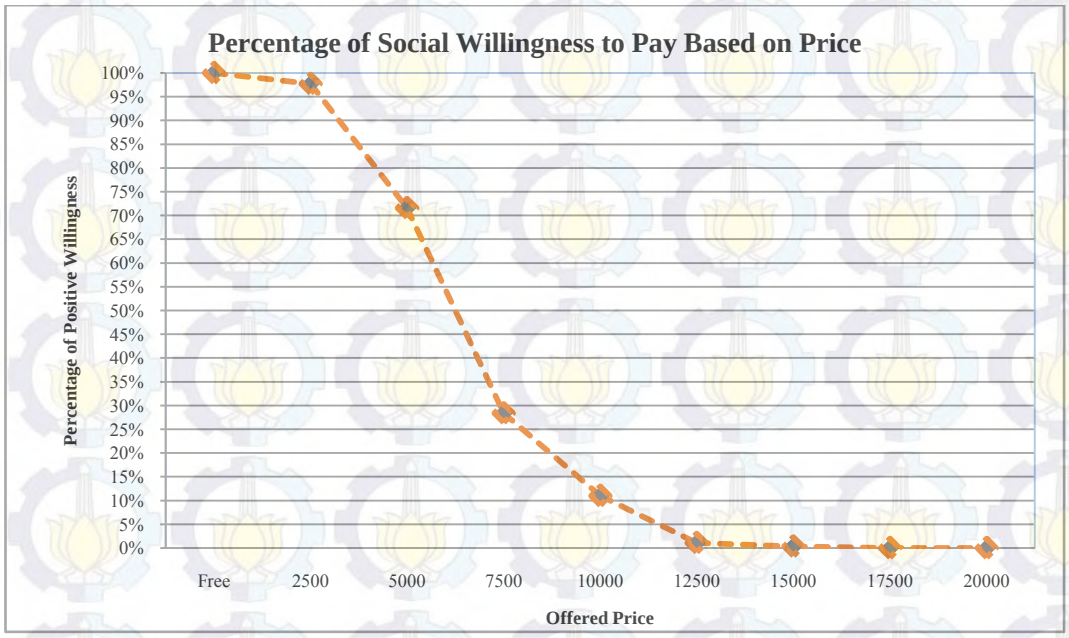


Figure 4.8 Positive Willingness to Pay Based on Price

WTP based on price was also assessed among potential MRT users. Ninety-eight percent, people choose MRT price located in 2500 IDR. Seventy-two percent, people willing to pay MRT price in 5000 IDR. People unwilling to pay MRT price range among 15000 IDR up to 20000 IDR. The 50 % willingness level is located between 5000 IDR and 7500 IDR. The result of WTP based on price becomes the consideration to determine cost recommendation of monorail and tram. There are a lot of decision which one the taken percentage, whether 50 % or other consideration factor. The other factor will be taken by considering the MRT specification that served in previous literature review about SMART information.

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CHAPTER 5
ANALYSIS AND DISCUSSION

This chapter explains about data analysis as the result data processing from previous chapter. It consists of the analysis of readiness of use, willingness to shift, and willingness to pay. There are two parts of willingness to pay which are used to compare result of the appropriate transportation attributes and cost of monorail and tram.

5.1 Readiness of Use Analysis

This readiness analysis is divided into two parts, for whole data and socioeconomics classification.

❖ Whole data

There were three factors of social readiness for monorail and tram. First, change into monorail and tram, the result readiness level of monorail was higher than tram because the number of refused people in tram was higher than monorail. Second, travel destination factor, the result for monorail was also higher than tram. Generally for this factor, people do not have problem wherever the location of station. Third, environmental impact factor, the result was the same as previous factor.

People prefer to use monorail because they think that tram has possibility to add road congestion. They realize that tram and its mode give more transportation capacity. But, the willing respondents because of reducing pollution are still high. The eco-green concept of new transportation type becomes the reason to support society willing to use monorail and tram. As result, among three factors, the highest readiness level is environmental effect factor. The average readiness levels are 93 % for environmental factor, 89 % for travel destination factor, and 78 % for change to monorail and tram factor.

People still have pro-environmental attitude. It means that policy maker as Surabaya government should offer high environmental benefits of using monorail and tram to society.

In other hand, the significant refusing level comes from walking distance 1 km to station. Surabaya government should consider the number station unit and the coverage area per station. A lot of people do not willing to walk if the coverage area of each station is more than 1km.

❖ Socioeconomics classification

This readiness level based on socioeconomics is classified into three aspects. First, gender aspect shows that both of female and male have similarity of readiness level. The highest readiness level for gender aspect is caused by environmental effect factor. It shows that people care about environmental condition, such as pollution, congestion, and accident. From Status Lingkungan Hidup Surabaya, CO_2 emission of transportation was significantly growing up. Amount of CO_2 emission in 2013 is around fourteen times of previous year.

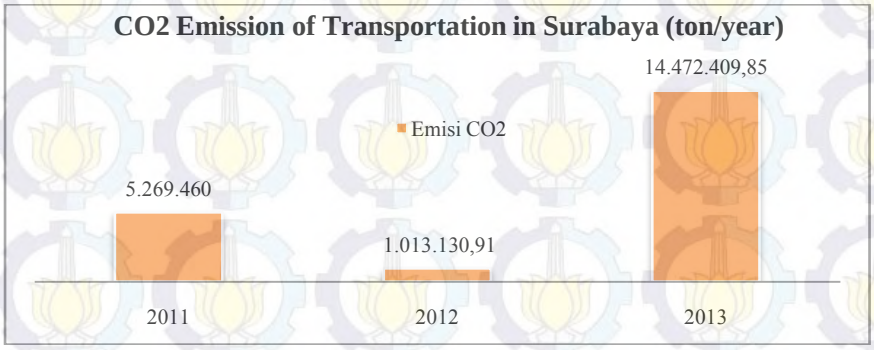

Figure 5.1CO2 Emission Rate of Transportation in Surabaya
Source: (Status Lingkungan Hidup (SLHD) Kota Surabaya, 2014)

Respondents want a change to reduce the increasing of pollution and congestion by developing green technology with renewable energy or no BBM. The respondent behavior about transportation is pro-environmental attitude.

Second, income aspect shows that all income categories have higher readiness level for monorail than tram with no significant willing number. For respondents who have income more than 15 millions totally ready to use monorail and tram in all factors.

Third, daily transportation aspect also shows the same readiness result from the previous factors. The highest refusing level of using monorail and tram is motorcycle user. They consider where the cheaper between using MRT and motorcycle with consuming BBM. Government should hardly socialize the future condition of urban city by using eco-green transportation which can interest people to choose MRT than their private transportation. Surabaya people want to improve their life, especially for urban transportation.

Overall, based on socioeconomics classifications, the significant refusing level also comes from reducing private transportation and walking distance 1km to the station. People have been accustomed to use private transportation (car or motorcycle) to go anywhere, whether near or far destination. The increasing circulation of motorcycle sales per year is also the reason making the number of motorcycle user is growing up. Government should propose the policy to limit the number of owned private transportation to reduce the booming of road capacity.

5.2 Willingness to Shift (WTS) Analysis

Willingness to shift result concerns in four parts, which are:

❖ WTS for walking distance motive

The total percentage that says "YES" for walking distance motive is 79.9 % and says "NO" is 20.1%.

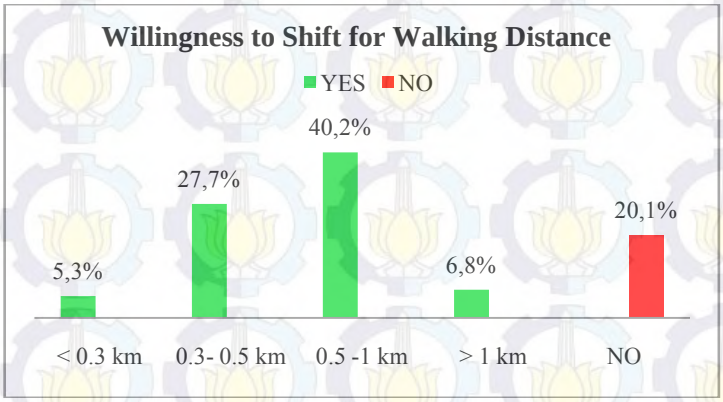

Figure 5.2Willingness to Shift for Walking Distance Motive

Based on results of WTS for walking distance motive, most of people willing to walk to monorail and tram station with less than 1 km. If the walking distance

is more than 1 km, a lot of people will not walk to station and certainly use their private transportation. Some respondents who have near travel destination willing to shift monorail and tram with near walking distance. This condition shows that Surabaya people have less walking behavior, moreover it is supported by the geography of Surabaya city which has high temperature. So, they will choose the fast way by using private transportation. By this condition, the maker policy must be attention in determining the station distance and bus feeder stops from the living place of society. The preferred distance from MRT station is less than 500 meter.

❖ WTS for bus feeder motive

The result of willingness to shift for using bus feeder motive is:

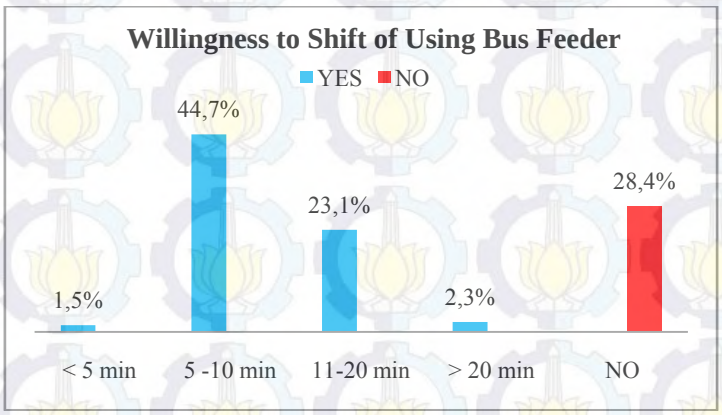

Figure 5.3Willingness to Shift with Tolerance of Bus Feeder Time Motive

The result shows 71.6 % of respondents who say "YES" and 28.4% say "NO". In WTS for bus feeder, the unwilling number is higher than that the WTS for walking distance. The highest tolerance for bus feeder inter-arrival time is around 5 until 10 minutes. Some of them think that bus feeder is the supported facility. People do not prefer to spend their money by using double public transportation. They like directly going to MRT station by motorcycling or walking. But, this result can help Surabaya government to decide the number of bus feeder by considering the waiting tolerance. More than 50%, the waiting tolerance has located in less than equal 10 minutes. If the waiting time is too long, people will choose to use the other transportations.

❖ WTS for parking lot motives

The result of willingness to shift for parking lot cost motive with two types of cost (per hour and per day) is:

Table 5.1Parking Lot Cost

Cost of parking lot	
Per hour	**Per day**
<1000IDR	<10000IDR
1000-1999IDR	10000-24999IDR
2000-5000IDR	25000-50000IDR
>5000IDR	>50000IDR

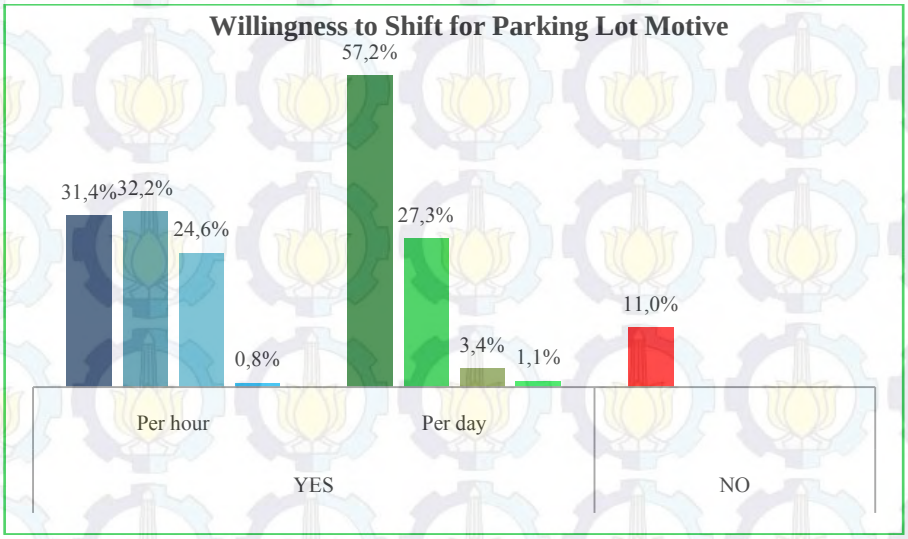

Figure 5.4 Willingness to Shift with Parking Lot Cost Motive

For per hour results, commonly, people are willing to spend for parking lot cost is less than 5000 IDR. For per day, they are willing to spend for perking lot cost is less than 25000 IDR. Most of them determine parking cost by comparing the existing cost in several places, such as mall, terminal, or station. In this case, the determination of parking cost should not be too expensive because the parking will be available every day. It is the support facility of monorail and tram, which means that all society level from low until high income also use this public facility.

The determination of parking cost can influence the total parking capacity, which directly affects the space area to build up parking area. If the parking cost of MRT facility is cheaper than that of the other place, the needed parking space

will be larger. So, policy maker must consider the available space for parking area before determining the parking cost.

- WTS or transportation attributes

Based on result of willingness to shift for transportation attributes, there is no significant difference between manual and card payment system. More than 50 %, people prefer to use card system because the easiness to save. By this card, the payment circulation can be controlled. From operation days, most 90% respondents choose seven days. It shows that public transportation becomes the basic demand in urban city.

From operation hours, people prefer to choose 5 AM- 10 PM or 5 AM -12 PM. There is no significant result for both choice, but 5 AM- 10 PM is higher than 5 AM -12 PM. It indicates that the probability of customer uses public transportation in late night is small. Based on inter-arrival time, more 50 % people choose the smallest range, 10 minutes. So, government decision about inter-arrival time in 10 minutes has supported the customer demand.

5.3 Willingness to Pay (WTP) Analysis

In this WTP analysis, there are two categories, WTP Option and WTP based on price. WTP option is used to evaluate the result of social willingness to pay, transportation option. Meanwhile, WTP based on price assesses the approximate price to propose monorail and tram tariff.

5.3.1 Willingness to Pay Option Analysis

Mobility is an important issue for current and future life service for urban city. The differences respondent‟s characteristics among several areas in Surabaya influence vary of the chosen option for public transportation service. The one attribute for which from all MRT types preferred seven days was Monday-Friday option. The determining whether coefficients within transportation option each MRT used hypothesis test. A joint Chi-squared test is used to determine if the two transportation coefficients are statistically different from each other with a null hypothesis that the coefficients are jointly equal between monorail and tram.

Based on the number of options, null hypotheses are divided into two, two options and three options. Here is the result of Chi-squared hypothesis test of coefficients between two MRT transportations.

Table 5.2Chi-squared Hypothesis Test of Coefficients Associated with Transportation Variables

Null Hypothesis		X^2	$P>\|X^2\|$
	Monorail		
Two options			
	$\beta_{M-F} = \beta_{Seven\ days}$	4.48019	0.034
	$\beta_{Enoug\ h} = \beta_{Cleaned}$	11.3199	0.001
	$\beta_{Free} = \beta_{Scheduled}$	7.41915	0.006
	$\beta_{Schedule} = \beta_{Operator}$	6.06061	0.014
Three options			
	$\beta_{>15\ min} = \beta_{15\ min}$	5.66793	0.017
Inter-arrival	$\beta_{>15\ min} = \beta_{10\ min}$	9.81818	0.002
	$\beta_{15\ min} = \beta_{10\ min}$	1.72841	0.189*
	$\beta_{5AM-6PM} = \beta_{5AM-10PM}$	2.22893	0.135*
Operation hours	$\beta_{5AM-6PM} = \beta_{5AM-12PM}$	3.8029	0.051*
	$\beta_{5AM-10PM} = \beta_{5AM-12PM}$	9.84252	0.002
	Tram		
Two options			
	$\beta_{M-F} = \beta_{Seven\ days}$	11.5227	0.001
	$\beta_{Enoug\ h} = \beta_{Cleaned}$	6.6000	0.010
	$\beta_{Free} = \beta_{Scheduled}$	6.23743	0.013
	$\beta_{Schedule} = \beta_{Operator}$	7.33333	0.007
Three options			
	$\beta_{>15\ min} = \beta_{15\ min}$	1.76534	0.184*
Inter-arrival	$\beta_{>15\ min} = \beta_{10\ min}$	3.28996	0.070
	$\beta_{15\ min} = \beta_{10\ min}$	1.87315	0.171*
	$\beta_{5AM-6PM} = \beta_{5AM-10PM}$	1.60655	0.205*
Operation hours	$\beta_{5AM-6PM} = \beta_{5AM-12PM}$	5.51357	0.019
	$\beta_{5AM-10PM} = \beta_{5AM-12PM}$	4.55983	0.033

*Higher than 5% P-value, meaning to reject Null Hypothesis

Based on the results of hypothesis test of coefficients associated with transportation variables, there are some significant attributes such, (1) inter-arrival and (2) operation hours in both monorail and tram. Those attributes are $\beta_{15\ min} = \beta_{10\ min}$ in inter-arrival and $\beta_{5AM-6PM} = \beta_{5AM-10PM}$ in operation hours. It means that all of those attributes have statistically different of coefficients result. The tests indicated the respondents responded to the choice variables similarly among the two MRT, but the effects of the socio-demography variables on respondent"s transportation option decisions vary between monorail and tram. Such differences are in choosing option of monorail and tram based on their socioeconomics characteristics. For no significant hypothesis, the policy maker does not need consider the effect of those attributes. For example, it is no problem for choosing

Monday-Friday or seven days. But, significant hypothesis should be considered by policy maker in determining whether which one the preferable transportation attributes.

The preferred transportation attributes were declared by the result of WTP estimation for each attributes. Transportation option can show the level of positif willingness of each attributes in both of monorail and tram.

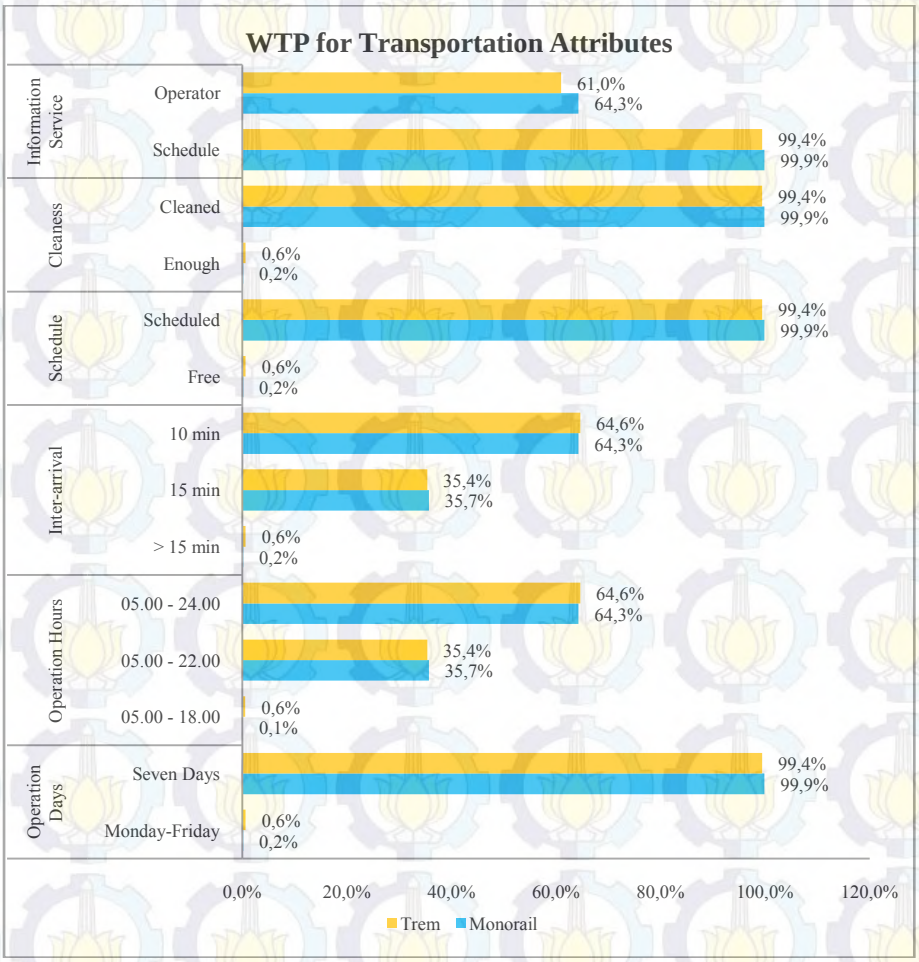

Figure 5.5 WTP Estimation for Transportation Attributes

The results indicated that each attribute in both transportations have similarity value of WTP estimation. Respondent think that both transportations have similarity characteristics, so most of them take the balance preferred between monorail and tram service. Most of respondent choose the same option for monorail and tram option. As the example, respondents who choose option 1 for

monorail also take option 1 for tram. There is little respondent who has different option for both transportation. They do not have big priority in one mode, sometimes monorail becomes the preferable transportation for first destination and tram is preferable for other destination. So, respondent will use whether monorail or tram based on the nearest station from living place and destination place.

Otherwise, the comparison among WTP estimations for each monorail and tram shows the different in several attributes. Respondents concern in detail for service quality of both mode. Unfortunately, the results of WTP estimations and comparison of percentage of positive WTP for monorail and tram are different.

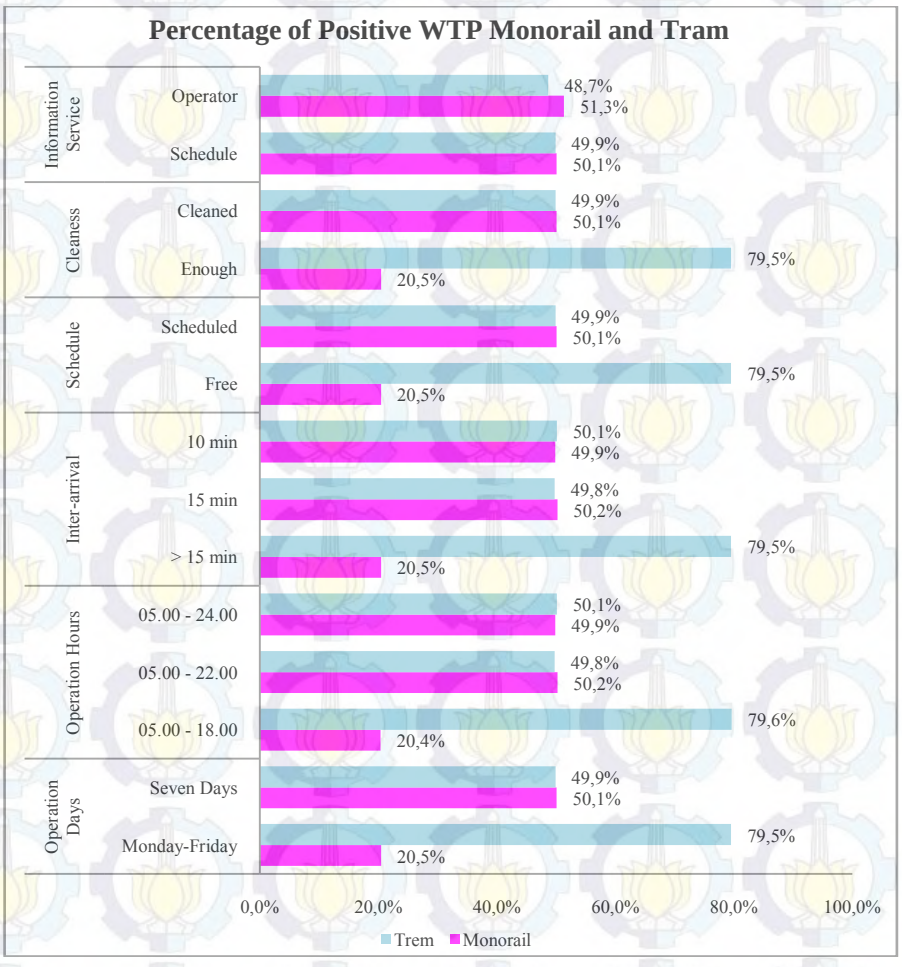

Figure 5.6 Percentage of Positive WTP Boyorail and Surotram

Percentage of positive WTP for Boyorail and Surotram shows unexpected result in certain attributes, some transportation attributes are significantly different between Boyorail and Surotram, (1) enough alternative in cleanness attribute, (2) free alternative in schedule attribute, (3) > 15 minutes in inter-arrival attribute, (4) 5 AM- 6 PM in operation hours attribute, (5) Monday-Friday in operation days attribute. All of those attributes are located in option 1. That condition shows that the number of respondent who choose Option 1 for tram is higher than that of monorail. However, option 1 has low service quality for transportation. Option 1 has significant different from Option 2 and Option 3. Some attributes in Option 2 and Option 3 are the same which makes the result of Positive WTP attributes in Option is significant different. But, respondent think outstanding for Surotram expectation, then they want to have significant different service between monorail and tram type. It indicates that the better facility of Boyorail needs more attention for SMART project manager. Logically, people will choose the best option, Option 3. Other cause maybe there are unconsistency in answering the questionnaire about willingness to pay option.

From a policy maker‟s standpoint, the results indicated support for improved transportation for better service life of urban city. The differences service qualities of both transportations need more attention to fulfill the preferred respondent. Basically, most of respondents choose option 1 for tram and option 2 or option 3 for monorail.

On the other hand, the except of those significant attributes, such as attributes in option 2 and option 3 can be references for policy makers to take service quality for monorail because respondent does not matter about them. May be the most important inference from the results is that transportation mode will give benefits for Surabaya people. So, the determination of transportation service should be considered by the amount of investment cost and the payback value from its tariff.

5.3.2 Cost Recommendation Analysis

In the previous chapter, WTP based on price shows that all respondents willing to use monorail and tram if the tariff is free. The higher monorail and tram

tariff, the lower of respondent willing to pay those transportation. A respondent chooses willing to pay MRT tariff at 15000 IDR. It means that tariff more than 15000 IDR cannot be used as MRT tariff. The tariff decision can be taken along free point up to 15000 IDR.

This research takes two considerations to propose monorail and tram cost. There are two results of cost recommendation, (1) the range is 5000 IDR up to 7500 IDR coming from fifty percent of sample. If the taken decision of MRT tariff is 50% of willingness to pay, the result of interpolation is 6250 IDR. (2) The consideration is based on MRT specification. The calculation concerns in MRT need for fleet, demand, capacity, circuit, and total stations.

Table 5.3 Cost Recommendation Calculation Based on MRT Specification

WTP BASED ON PRICE CALCULATION					
SPESIFIKASI MRT	**MONORAIL**		**TRAM**		**Surabaya Population**
NEED FOR FLEET (UNIT)	**18**		**21**		**3,022,481**
CARRIAGE	**4**		**5**		
CAPACITY/CIRCUIT	**400**	**500**	**200**	**300**	
TRAINS/ CIRCUIT	**4**	**5**	**2**	**3**	
CIRCUIT	**2**	**2**	**9**	**1**	
CAPACITY (PSG/TRAIN)	**100**	**100**	**100**	**100**	
STATION	**25**		**36**		
CAPACITY/CIRCUIT	6,400	8,000	18,000	3,000	
TOTAL CAPACITY	14,400		21,000		
CAPACITY PER DAY	172,800		252,000		
DEMAND/YEAR	**53,942,104**		**40,737,896**		
Demand/ day	149,839		113,161		
Percentage of WTP	5.72%		8.34%		
Range	10,000-12,500 IDR		10,000-12,500 IDR		
WTP of MRT Tariff	**11,337 IDR**		**10,672 IDR**		

Capacity per circuit means that each departure for monorail consists of four trains. This calculation assumes that customers use monorail and tram to go to the second stop after their initial point. So, from the initial station to the second stops after initial station means one trip. Logically, people do not want to use MRT for only one stop because they prefer to use their private transportation. So, the total capacity comes from the total capacity circuit for both circuit types. In

addition, the value of capacity per day comes from multiplication of total stops divided by two (based on the assumption of one trip) and total capacity. The travel route is form depot back to depot again. It also shows that the demand per day can be covered by the capacity per day.

The percentage of WTP for monorail is 5.72 % and 8.34 % which come from capacity per total existing population. As result, the price calculation based on MRT specification shows that the range value is 10000 IDR up to 12500 IDR with specific price is 11337 IDR for monorail and 10672 IDR for tram. Government policy in determining monorail and tram tariff should compare several considerations, such as (1) the WTP price considering the MRT specification, (2) the adjusted percentage of WTP price of the most respondents willing, (3) the preferable transportation service from WTP option, to get the best payback period of spending investment.

CHAPTER 6
CONCLUSION AND RECOMMENDATION

This chapter consists of conclusion and recommendation of this SMART research. Conclusion answers the objectives of research and recommendations gives additional suggestion about the next research and SMART project.

6.1 Conclusion

The conclusions of Measuring Readiness and Willingness to pay (WTP) of SMART, monorail and tram research study are:

1. The readiness level study indicates that the majority are ready to use monorail and tram in all readiness factor, especially highly ready to consider environmental impact aspect. Based on socioeconomic classification, (1) gender, the readiness level of female is higher than male. (2) Income, the majority also is ready to use monorail and tram and totally agreed for income more than 15 million. (3) Daily transportation, the results is the same as overall readiness level. The more attention factors with low readiness level for policy maker consideration are walking distance 1km to station and reducing private transportation.

   Willingness to shift study indicates that the majority are willing to use monorail and tram with several motives, such as (1) walking distance, mostly prefer less than 1 km, (2) bus feeder tolerance with maximum waiting 10 minutes, (3) parking lot, mostly prefer to get the cheaper cost, (4) transportation attribute, mostly choose the best transportation service.
2. The result of social willingness to pay study of monorail and tram indicates most of people choose the same option for both transportations, no different priority in one mode. Overall, the majority has no problem whether using monorail or tram depended on the station location from living and destination place. Respondents prefer to choose Option 1 as the tram attributes and Option 2 and Option 3 as the monorail attributes. Respondent does not matter of both options which one the preferable option. However, the comparison

results between monorail and tram indicate that respondents have higher expectation service quality for monorail than that of the tram. In detail attributes, the most preferable transportation attributes is located in option 3. But, policy maker can take the transportation attributes in whether option 2 and option 3 because of no significant different. For WTP price, over 70% of respondents choose 5000 IDR and only 28% for 7500 IDR. Only one respondent is willing to pay price 15000 IDR.

3. There are two cost recommendations for MRT, monorail and tram based on the result of WTP surveys or consumer sight. First comes from adjusted fifty percent of willingness survey around 5000 IDR up to 7500 IDR with specific nominal 6250 IDR. Second comes from the calculation of MRT specification by considering the number of need for fleet, demand, capacity, and total stations. The calculation shows that percentage of WTP price is located in 5.72% for monorail and 8.34 % for tram. Finally, both of monorail and tram have price range around 10000 IDR up to 12500 IDR. The specific nominal is 11337 IDR for monorail and 10672 IDR for tram. But, the implementation of monorail and tram tariff is totally depended on several considerations, such as (1) the WTP price considering the MRT specification, (2) the adjusted percentage of WTP price of the most respondents willing, (3) the preferable transportation service from WTP option.

6.2 Recommendation

The recommendations of this research study are:

1. For practical aspect, this study can be used to help the policy maker as Surabaya government in determining MRT (monorail and tram) tariff by considering the service quality, benefits, and customer willingness. Especially, the indirect benefit is the tourism aspect to increase the foreign exchange.
2. For the future research, (a) the same case, the study should conduct with more preferable and applicable method, such as combining WTP option and WTP price. (b) This study can be used to do other research scopes, such as measuring subsidized BBM and reducing private transportation.

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Appendix A Questionnaire Design

(BAPPEKO, 2015)

Page 1

KUESIONER RISET TEKNIK INDUSTRI

INSTITUT TEKNOLOGI SEPULUH NOPEMBER

SMART (Surabaya Mass Rapid Transit)

SMART merupakan proyek transportasi angkutan massal cepat Surabaya.*Monorail* dan *Tram* adalah kereta api yang memiliki rel tunggal dalam track dan memiliki ukuran yang lebih besar dari kereta rel.Salah satu pertimbangan utamanya adalah lebih rendahnya subsidi yang dikeluarkan dibanding dengan bus kota.Disamping itu, *monorail* dan *tram* juga lebih mampu mengurangi emisi pencemaran udara dan memberikan pelayanan yang lebih baik dibanding bus kota. Proyek SMART akan memiliki 2 jenis yaitu **Boyorail** menggunakan jenis moda monorel dan **Surotram** untuk trem.

1. Boyorail (Monorel)

Boyorail akan dibangun untuk koridor timur barat mulai dari stasiun Kejawan-Kenjeran sampai dengan stasiun Lidah Kulon dengan panjang lintasan 23 Km dengan jumlah stasiun monorail-nya sebanyak 23 stasiun.

2. Surotram (Trem)

Surotram diperuntukkan untuk koridor Utara-Selatan mulai dari Joyoboyo dan Jembatan MerahPlaza dengan panjang lintasan 16.7 Km.

No. Kuesioner

Nama Surveyor :.....

Part 1. Data Diri Responden

1. Nama :.....
2. Alamat :.....

Berikut ini pilih jawaban yang sesuai

3. Jenis Kelamin

   ☐ Laki-Laki ☐ Perempuan

4. Pekerjaan

   ☐ PNS ☐ Pegawai swasta

   ☐ Mahasiswa/Pelajar ☐ Ibu Rumah Tangga

   ☐ Wiraswasta ☐ Lain-lain:.....

5. Jumlah Pendapatan

   Berapa nilai nominal pendapatan/uang saku (untuk mahasiswa) Anda: Rp .....

   ☐ <3 juta ☐ 3 -7,5 juta ☐ 7,5 -15 juta ☐ > 15 juta

6. Kendaraan yang dimiliki:

   ☐ Mobil ke-(1, 2,3, n) cc: (1).....(2).....(3).....

   Tahun keluar : (1).....(2) ....., (3) .....

   ☐ Sepeda motor ke (1,2,3,n) cc: (1).....(2).....(3).....

   Tahun keluar : (1).....(2) ....., (3) .....

7. Penggunaaan kendaraan

   ☐ setiap hari ☐ 3-4 kali seminggu

   ☐ 1 kali seminggu ☐ kurang dari 1 kali seminggu

8. Tujuan penggunaan kendaraan:

   ☐ Bekerja ☐ Berbelanja ☐ Wisata/Lifestyle

   ☐ Belajar/Sekolah ☐ Lainnya:.....

9. Daerah yang dituju?.....

10. Tipe BBM apakah yang sering Anda gunakan setiap harinya

    ☐ Premium ☐ Pertamax ☐ Solar ☐ BBG

11. Volume BBM yg dikonsumsi kendaraan anda:

    Rata-Rata : Rp (liter)...../minggu

    ☐ < 2 liter/minggu ☐ 2- 10 liter/minggu

    ☐ 11-25 liter/minggu ☐ > 25 liter/minggu

12. Beraparata-rata jarak tempuh kendaraan Anda seharinya:.....km
13. Pada pendapatan berapakah (per bulan) Anda akan membeli mobil?

    Rp.....

14. Sudah berapa kali Anda berganti mobil?.....kali

    Selang berapa lama Anda berganti mobil?.....tahun

15. **Apakah Anda mengetahui tentang monorel atau trem (Surabaya *Mass Rapid Transit*)?**

    ☐ Ya ☐ Tidak

Part 2. Kesiapan Untuk Berpindah (*Readiness*)

1. Kendaraan apa yang sering Anda gunakan sehari-hari? (*centang salah satu*)

   ☐ Mobil ☐ Sepeda Motor ☐ Angkutan Umum ☐ lain-lain: .....

2. Centanglah pilihan Anda! (*diprioritaskan tidak memilih nomor 3*)

   Skala 1: Sangat Tidak Bersedia 2: Tidak Bersedia 4: Bersedia 5 : Sangat Bersedia

Faktor	Sub Faktor	Pertanyaan	Monorel					Trem				
			1	2	3	4	5	1	2	3	4	5
1. Berpindah ke Monorel dan Trem	1.1 Pengurangan kendaraan pribadi	Apakah Anda bersedia untuk beralih untuk menggunakan Monorel dan Trem?										
	1.2 Jarak Stasiun	Apakah Anda bersedia jika stasiun pemberhentian berjarak maksimum 1km meter dari tempat tinggal?										
2. Tujuan Perjalanan		2.1 Apakah Anda bersedia jika stasiun pemberhentian berada di dekat pusat pemerintahan?										
		2.2 Apakah Anda bersedia jika stasiun pemberhentian berada di dekat fasilitas pendidikan (sekolah/universitas)?										
		2.3 Apakah Anda bersedia jika stasiun pemberhentian berada di dekat tempat wisata?										
		2.4 Apakah Anda bersedia jika stasiun pemberhentian berada di dekat pusat perbelanjaan?										
3. Dampak Lingkungan	3.1 Kemacetan	Apakah Anda bersedia beralih menggunakan Monorel dan Trem untuk mengurangi kemacetan?										
	3.2 Polusi	Apakah Anda bersedia beralih menggunakan Monorel dan Trem untuk mengurangi polusi?										
	3.3 Kecelakaan	Apakah Anda bersedia beralih menggunakan Monorel dan Trem untuk mengurangi terjadinya kecelakaan?										

Part 3. Kesediaan Untuk Berubah (*Willingness to Shift*)

Centanglah pilihan Anda!

1. Apakah Anda bersedia untuk berjalan kaki menuju stasiun Monorail atau Trem terdekat?

   ☐ Ya ☐ Tidak

   Berapa jarak maksimum berjalan kaki yang Anda toleransi: .....Km

2. Apakah Anda bersedia menggunakan bus feeder/angkutan menuju stasiun Monorail atau Trem terdekat?

   ☐ Ya ☐ Tidak

   Berapa waktu maksimum sampai ke stasion monorail ataru trem yang Anda toleransi: .....menit

3. Apakah Anda memerlukan fasilitas area parkir kendaraan di dekat stasiun Monorail atau Trem?

   ☐ Ya ☐ Tidak

   Bila iya, berapa tiket parkir yang diinginkan:

   (1) perjam : Rp.....

   (2) perharinya (inap) : Rp .....

4. Sistem pembayaran yang Anda pilih

   ☐ Manual

   ☐ Kartu/Electronic

5. Hari operasi yang Anda pilih?

   ☐ senin-jumat

   ☐ setiap hari

6. Waktu antar kedatangan yang Anda pilih?

   ☐ >15 menit ☐ tiap 15 menit

   ☐ tiap 10 menit

7. Jam operasi yang Anda pilih?

   ☐ 5 pagi - 6 petang ☐ 5 pagi - 10 malam

   ☐ 5 pagi - 12 malam

Part 4. Kesediaan Untuk Membayar (*Willingness to Pay*)

4.1 Kesediaan Untuk Membayar Tanpa Berdasarkan Harga

Centanglah salah satu pilihan Anda!

4.1.1 Monorel

Atribut	Opsi 1	Opsi 2	Opsi 3
Hari operasi	Senin-Jumat	Tujuh hari	Tujuh hari
Waktu antar kedatangan	> 15 menit	setiap 15 menit	setiap 10 menit
Jadwal	Bebas	terjadwal	Terjadwal
Jam operasi	5 pagi- 6 petang	5 pagi- 10 malam	5 pagi- 12 malam
Fasiltas Monorel			
Kebersihan	Cukup	Terjaga Kebersihannya	Terjaga Kebersihannya
Layanan informasi	Map perjalanan, tanpa jadwal, pengumuman keterlambatan	Map perjalanan, jadwal, pengumuman keterlambatan	Map perjalanan, jadwal, pengumuman keterlambatan, penjaga
Kotak centang	☐	☐	☐

4.1.2 Tram

Atribut	Opsi 1	Opsi 2	Opsi 3
Hari operasi	Senin-Jumat	Tujuh hari	Tujuh hari
Waktu antar kedatangan	> 15 menit	setiap 15 menit	setiap 10 menit
Jadwal	Bebas	terjadwal	Terjadwal
Jam operasi	5 pagi- 6 petang	5 pagi- 10 malam	5 pagi- 12 malam
Fasiltas Monorel			
Kebersihan	Cukup	Terjaga Kebersihannya	Terjaga Kebersihannya
Layanan informasi	Map perjalanan, tanpa jadwal, pengumuman keterlambatan	Map perjalanan, jadwal, pengumuman keterlambatan	Map perjalanan, jadwal, pengumuman keterlambatan, penjaga
Kotak centang	☐	☐	☐

4.2 Kesediaan Untuk Membayar Berdasarkan Harga

Centanglah pilihan Anda!

No	Pertanyaan	Jawaban
1	Apakah Anda bersedia apabila harga tiket Monorail dan Trem gratis?	☐Ya ☐Tidak
2	Apakah Anda bersedia apabila harga tiket Monorail dan Trem Rp 2.500,-?	☐Ya ☐Tidak
3	Apakah Anda bersedia apabila harga tiket Monorail dan Trem Rp 5.000,-?	☐Ya ☐Tidak
4	Apakah Anda bersedia apabila harga tiket Monorail dan Trem Rp 7.500,-?	☐ Ya ☐Tidak
5	Apakah Anda bersedia apabila harga tiket Monorail dan Trem Rp 10.000,-?	☐Ya ☐Tidak
6	Apakah Anda bersedia apabila harga tiket Monorail dan Trem Rp 12.500,-?	☐Ya ☐Tidak
7	Apakah Anda bersedia apabila harga tiket Monorail dan Trem Rp 15.000,-?	☐Ya ☐ Tidak
8	Apakah Anda bersedia apabila harga tiket Monorail dan Trem Rp 17.500,-?	☐ Ya ☐ Tidak
9	Apakah Anda bersedia apabila harga tiket Monorail dan Trem Rp 20.000,-?	☐ Ya ☐Tidak

Terima kasih atas isiannya, tanpa partisipasi anda, penelitian kami tidak akan terlaksanan dengan baik.

Appendix B Questionnaire Distribution

Table1Sample Frame of Questionnaire Distribution

NO	Kecamatan	Population	Sample per District		SAMPLE
			Proportion	Target	
1	Suko manunggal	101617	0,034	12	12
2	Tandes	95458	0,032	12	12
3	Asem Rowo	42580	0,014	6	6
4	Benowo	50388	0,017	7	7
5	Pakal	44811	0,015	6	5
6	Lakarsantri	53466	0,018	7	7
7	Sambikerep	57452	0,019	8	8
8	Genteng	67659	0,022	9	9
9	Tegalsari	113772	0,038	14	1
10	Bubutan	113181	0,037	14	12
11	Simokerto	104836	0,035	13	2
12	Pabean Cantikan	91148	0,030	12	8
13	Semampir	199011	0,066	25	18
14	Krembangan	125800	0,042	15	6
15	Bulak	40178	0,013	6	2
16	Kenjeran	142625	0,047	18	16
17	Tambaksari	235457	0,078	29	10
18	Gubeng	151413	0,050	19	16
19	Rungkut	102208	0,034	13	8
20	Tenggilis Mejoyo	54761	0,018	6	6
21	Gunung Anyar	50760	0,017	7	7
22	Sukolilo	107360	0,036	14	12
23	Mulyorejo	85250	0,028	11	8
24	Sawahan	225319	0,075	28	3
25	Wonokromo	187165	0,062	23	20
26	Karangpilang	75012	0,025	9	8
27	Dukuh Pakis	61392	0,020	8	8
28	Wiyung	66392	0,022	9	9
29	Gayungan	47439	0,016	7	6
30	Wonocolo	81152	0,027	10	5
31	Jambangan	47419	0,016	7	7
Total		3022481	Total	384	264
			Mean	12.387	8.5161
			Std. Deviation	6.509	4.538

Appendix C Percentage of Positive Willingness to Pay Calculation

Table 2 Calculation of Percentage Positive WTP

Attributes	Mean WTP		Normal Cumulative Distribution		Percent		Comparison	
	Monorail	Tram	Monorail	Tram	Monorail	Tram	Monorail	Tram
Operation Day								
Monday-Friday	2.937798067	2.487909718	0.998347239	0.993575183	0.2%	0.6%	20.5%	79.5%
Seven Days	-2.974735506	-2.5284292	0.001466206	0.00572871	99.9%	99.4%	50.1%	49.9%
Operation Hours								
05.00 - 18.00	2.974735506	2.528429201	0.998533794	0.99427129	0.1%	0.6%	20.4%	79.6%
05.00 - 22.00	0.366842948	0.375366715	0.643131915	0.646306122	35.7%	35.4%	50.2%	49.8%
05.00 - 24.00	-0.366842948	-0.37536671	0.356868085	0.353693878	64.3%	64.6%	49.9%	50.1%
Inter-arrival								
> 15 min	2.937798067	2.487909718	0.998347239	0.993575183	0.2%	0.6%	20.5%	79.5%
15 min	0.366842948	0.375366715	0.643131915	0.646306122	35.7%	35.4%	50.2%	49.8%
10 min	-0.366842948	-0.37536671	0.356868085	0.353693878	64.3%	64.6%	49.9%	50.1%
Schedule								
Free	2.937798067	2.487909718	0.998347239	0.993575183	0.2%	0.6%	20.5%	79.5%
Scheduled	-2.974735506	-2.5284292	0.001466206	0.00572871	99.9%	99.4%	50.1%	49.9%
Cleaness								
Enough	2.937798067	2.487909718	0.998347239	0.993575183	0.2%	0.6%	20.5%	79.5%
Cleaned	-2.974735506	-2.5284292	0.001466206	0.00572871	99.9%	99.4%	50.1%	49.9%
Information Service								
Schedule	-2.974735506	-2.5284292	0.001466206	0.00572871	99.9%	99.4%	50.1%	49.9%
Operator	-0.366842948	-0.27943503	0.356868085	0.389955494	64.3%	61.0%	51.3%	48.7%

BIOGRAPHY

Author was born in Kediri, 10 February 1994 and the first daughter of three children. Author had studied formal education in TK Yapiston, Wonokromo Elementary School, 1st Kandangan Junior High School, and Khadijah Senior High School. After senior high school graduation, author registered through SNMPTN Undangan Bidikmisi. Author was accepted in Industrial Engineering Department ITS Surabaya in 2011 with 2511100041. During education process, the author became a finalist of scientific writing competition in 2013 about Advocation of Indonesia Goverment Brawijaya University and a finalist of product design competition Inception Islam Indonesia University in 2014. The author also had Astra Daihatsu Motor Internship, Jakarta in July-August 2014 period in Logistics Press Stamping Department. The available e-mail is putrid.nur.imani@gmail.com.