

# Determination of Sustainability Criteria in Strategic Appraisal of Mass Transit Development Policy Evaluation in the Greater Jakarta Metropolitan Area

Ofyar Z. Tamin<sup>1,2,a</sup>, Rudi Sugiono Suyono<sup>3,b</sup>

<sup>1</sup>Institute of Technology Bandung, INDONESIA

<sup>2</sup>Institute of Technology Sumatera, INDONESIA

<sup>3</sup>University of Tanjungpura, Pontianak, INDONESIA

<sup>a</sup>ofyarz@gmail.com, <sup>b</sup>rudisugiono@civil.teknik.untan.ac.id

**Keywords:** Criteria, Transport Strategic Appraisal, Mass Transport Development

**Abstract.** Criteria is something that we use to assess in evaluating progress toward goals and objectives. Those criteria have many uses: they can help identify trends, predict problems, assessing options, setting performance targets, and evaluate the jurisdiction or organization. Mass transport infrastructure development in developing countries is not easy. Its impact is not limited to this time but is long-term. Besides that, the organizing and operating of mass transportation engage many stakeholders with different interests which sometimes even contradict each other. With these consequences, it is necessary to consider a variety components, actors and stakeholders that involved in the implementation and operation of mass transit itself in a comprehensive assessment tools. The determination of the criteria is very important and crucial. It is important to carefully select criteria that reflect the overall goal. It is also important to be realistic when choosing criteria, data availability, ease to be understood and its use in decision making. This study has developed sustainability criteria by a method of election and appointment criteria based on sustainable transportation for strategic appraisal of mass transportation in the metropolitan areas of developing countries. This study has used Superimpose and Survey Interview / Questionnaire Methods. This method is used because can determine suitability of inter-related criteria required in the implementation of good mass transportation system. Furthermore, with the appropriate procedure, an assessment of each criteria - the criteria by each - each stakeholder through survey interviews / questionnaires. There are 4 (four) issues on which to base that issues related principles of sustainable development, issue of the root causes of mass transportation in developing countries, problems of public transport system in developing countries which are unique and different from those in developed countries, then issues related to the consideration of multi interests of actors involved, and last but not least, issues that considerations of global development strategic objectives in the Millennium Development Goals (MDGs). This research has successfully mapped the sustainability goals that the main criterion of the strategic appraisal of mass transit on economic, social, environmental and the technical / operational parameter. Every stakeholder has different sub criteria that derived from the man criteria that have been mapped. These results are then tested through survey interviews to stakeholders and tested validation.

## 1. Background

Criteria is something that we use to assess in evaluating progress toward goals and objectives. Those criteria have many uses: they can help identify trends, predict problems, assessing options, setting performance targets, and evaluate the jurisdiction or organization. Mass transport infrastructure development in developing countries is not easy. Its impact is not limited to this time but is long-term.

Besides that, the organizing and operating of mass transportation engage many stakeholders with different interests which sometimes even contradict each other. With these consequences, it is necessary to consider a variety components, actors and stakeholders that involved in the implementation and operation of mass transit itself in a comprehensive assessment tools. The determination of the criteria is very important and crucial. It is important to carefully select criteria that reflect the overall goal. It is also important to be realistic when choosing criteria, data availability, ease to be understood and its use in decision making. This study has developed sustainability criteria by a method of election and appointment criteria based on sustainable transportation for strategic appraisal of mass transportation in the metropolitan areas of developing countries.

## 2. Methodology

Selection of an evaluation criteria based on the identification of stakeholder objectives and goals of the alternatives considered. In the methodology, analysis and assessment of the impact of multi-actor, the criteria for evaluation are the goals and objectives of the stakeholders, and not the effect or impact of the action as is usually done in a multi-criteria analysis. In a natural way, this impact will be reflected in the objectives of the stakeholders (if all parties are in it).

This research attempts to develop criteria to be used in the Strategic Transport Appraisal for evaluation Mass Transportation Development Policy in a metropolitan area of developing countries by using the approach of Multi Actor Multi Criteria Analysis (MAMCA). MAMCA originally developed by [1]. In this method, each actor allowed to develop criteria in accordance with the objectives to be achieved by each of the actors. In this study, which evaluated the criteria developed in the conceptual framework as shown in the following diagram:

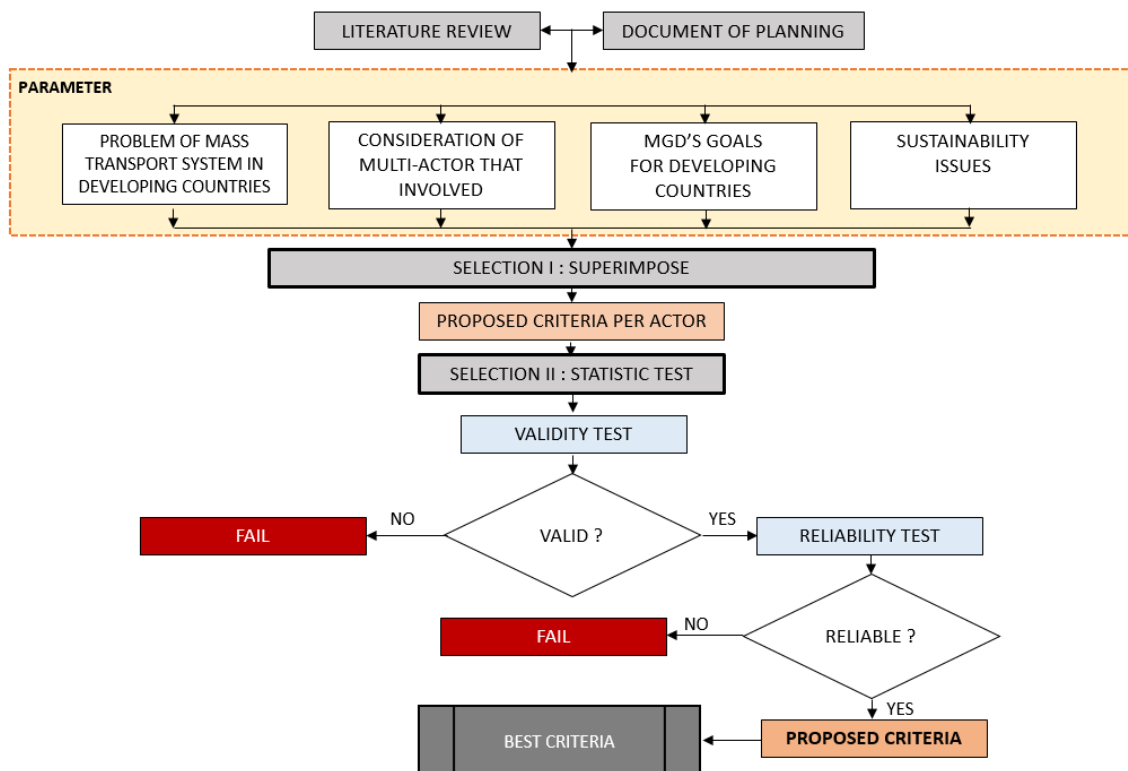


Fig. 1. Process of determining the criteria for the analysis of multi-actor and impact assessments

### 3. Candidate of Criteria (Long List Option)

Selection and definition of evaluation criteria based primarily on the identification of stakeholder objectives and goals of the alternatives considered. With this information, hierarchical decision tree (hierarchical decision tree) can be made. In MAMCA methodology, criteria for evaluation are the goals and objectives of the stakeholders, and not the effect or impact of the action as is usually done in a multi-criteria analysis. In a natural way, this impact will be reflected in the objectives of the stakeholders (if all parties are in it).

The weights are then determined by the importance stakeholders attached to each goal. For weighting, the existing methods can be used such as the allocation of 100 points, a direct allocation, and so forth. At this stage, the criteria previously identified stakeholders operated by establishing indicators (called metrics or variables) that can be used to measure whether, or to what extent, alternative contribute to each individual criterion.

#### 3.1. Objective criteria for Sustainability

Criteria is something that we use to assess in evaluating progress toward goals and objectives. Those criteria have many uses: they can help identify trends, predict problems, assessing options, setting performance targets, and evaluate the jurisdiction or organization. It is important to carefully select criteria that reflect the overall goal. It is also important to be realistic when choosing criteria, data availability, ease to be understood and its use in decision making [2]. The criteria for sustainability assessment study include:

- Economic Criteria  
Economic development refers to an advance in society within the framework of the achievement of economic objectives such as increased income, prosperity, employment and social welfare productivity.
- Social Criteria  
Social impacts include similarity, health (which also includes the economic impact if the spread of the disease resulted in financial expense and reduce productivity) and impact - direct or indirect impact on the social conditions of communities and regions.
- Environmental Criteria  
The environmental impact includes various types of air pollution, noise pollution, water pollution, the reduction of the use of nonrenewable resources and so forth.

Selection of public transport modes is an important decision in a new planning or development plans public transit systems that already exist. Decision making is very important. This selection not only determines the type of technology, operating systems and network characteristics planned, because through the elements - these elements will affect the pattern of physical development of urban, economic activity as well as social and environmental conditions of the region. Characteristic modes - public transport modes vary widely, there are some parts are quite interesting, and there are varying impacts that should be considered in the planning. Both were good analysis of absolute and comparative analysis of intermodal is a fairly complex.

#### 3.2. Root Problems of Mass Transportation in Developing Countries

Problem of mass transport system in developing countries are unique and different from those happen in developed countries [3]. The identification results conducted by researchers from several related literature managed to identify some of the root problems in the operational of mass transit system in developing countries (included the Greater Jakarta Area) can be mapped 7 (seven) the root causes of the principal problems related to mass transportation in a metropolitan area in developing countries, namely:

1. The problem of coordination among agencies and stakeholders / actors involved
2. The problem of the balance between demand and supply
3. The problem of inadequate financing and subsidy system that is not appropriate
4. Problems that are not participatory and comprehensive planning among the autonomy region in the metropolitan area.
5. Problem of minimum service standards that are not accountable (coverage area system, feeder systems (integration between modes), inadequate transport supply and problem of service
6. Problems of urban development and transport policy between regions (core and buffer region) that have not been well integrated.
7. The problem has not noticed linkages with economic, social and environmental (sustainability) adequately (social and environmental problems that are still marginalized)

### 3.3 Consideration of Multi Interests Actors Involved

Organization of mass transport systems involves many interests of the various actors involved. Every component involved in the implementation of public transit systems have different criteria and objectives, so often collide.

Thus, criteria and / or indicator ratings wherever possible to consider the interests of each stakeholder group are needed. Of course, since the relationship between stakeholders in urban public transport system is very complicated and interdependent, a very basic need for planning and implementation in the urban public transport system is the regulation, to keep all the "players" on the right track.

Table 1. Public transit system requirements between each actors involved

| Public Transit System Requirements |                                       |                                       |
|------------------------------------|---------------------------------------|---------------------------------------|
| User                               | Operator                              | Society/<br>Government                |
| Availability                       | Area Coverage                         | Capabilities Attractive<br>Passengers |
| Frequency / Headway                | Reliability                           | Cost System                           |
| Punctuality                        | Speed Of Cycle                        | Reliability In<br>Emergencies         |
| Speed / Travel Time                | Capacity                              | Social Interest                       |
| Comfort                            | Flexibility                           | The Environmental<br>Impact           |
| Availability Of Facilities         | Security And Safety                   | Energy Consumption                    |
| Security And Safety                | Costs And Benefits                    | Long-Term Impact                      |
| user cost                          | Capabilities Attractive<br>Passengers |                                       |
|                                    | Minimize the Side Effects             |                                       |

Source: ref. [4]

### 3.4 Consideration Achievement In the Millennium Development Goals (MDGs)

As an instrument of decision makers who are at a strategic level, it is one of the strategic objectives of development achievement refers to the Global MDGs. MDGs are the result of an agreement the Millennium Declaration heads of state and representatives from 189 countries of the United Nations (UN), which starts in September 2000, in the form of an eight-point goal to be achieved by the state of the world [5]. The target is reached welfare and community development. Although the initial target of the MDGs is 2015, but many countries remain committed to make the

post target of 2015 as a reference target achievement of development (otherwise known as the Post-2015 MDGs).

Now the MDGs has become an important reference for development in Indonesia and other developing countries, from the planning phase as stated in the Medium Term Development Plan to implementation. Although experiencing a constraint, but the government is committed to achieving these goals and it takes hard work and cooperation with all parties, including civil society, private sector, and donors. Achievement of the MDGs in Indonesia will be the basis for a cooperation agreement and its implementation in the future. This includes campaigns for debt swap agreement for developing countries in line with the Jakarta Declaration on MDGs in Asia and the Pacific region.

Table 2. Aim at MDGs

| No. | Aim at MDGs   | Sub Group                 |
|-----|---|---------------------------|
| 1   | To overcome poverty and hunger                              | Welfare and social equity |
| 2   | To achieve basic education for all                          |                           |
| 3   | To push gender balancing and woman empowering               |                           |
| 4   | To decrease number of children death                        | Healthy                   |
| 5   | To increase woman health                                    |                           |
| 6   | To fight to HIV/AIDS, malaria and other infectious diseases |                           |
| 7   | To increase awareness of environmental sustainability       | Environmental             |
| 8   | To develop global partnership for development in the world  | Equitable Development     |

Source: ref. [5]

#### 4. Analysis (Short List Option)

##### 4.1 Selection Phase I (Superimpose between parameter of criteria)

In the first stage selection is done super impose on various basis of decision criteria that have been mentioned above. The process of this super-impose most of this can be seen in figure 2.

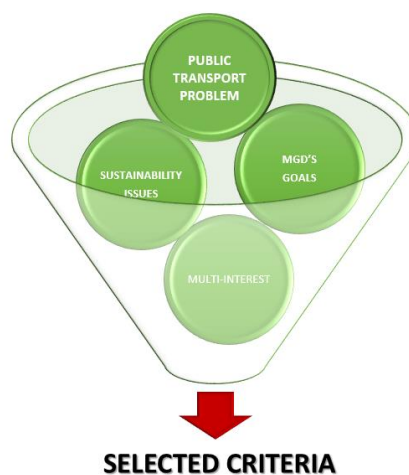


Fig. 2. Process of Superimpose Criteria

**4.2. Selection Phase II (Results of Short List Option)**

In this stage will test each item of criteria that produce by superimpose method by questionnaire instrument. Result of questionnaire survey then test using statistical tests such as validity and reliability testing on each criterion for each actor in each level of authority. These test results can be eliminated the invalid and unreliable criteria.

Furthermore, based on the analysis above, then by considering fairness factors and the achievement of sustainability goals are the same from all actors / stakeholders, it can researchers synthesize and then formulated the assessment criteria for the assessment of mass transportation, especially in developing countries prior specifically in the area of Indonesia (The Jakarta Greater Metropolitan Area) are as follows:

Table 3. Results (short list) of chosen criteria (E.g. Economic Parameter)

| STAKEHOLDER  | USER   |   |  | OPERATOR  |   |   |
|--|--|---|--|---|---|---|
| OBJECTIVE OF SUSTAINABILITY                          | CHOSEN CRITERIA  | TARGET  | BENCHMARK  | CHOSEN CRITERIA   | TARGET  | BENCHMARK   |
| Economic Productivity                                | 1 Allocation of expenses for transport (Transport Efficiency in Use) | Efficient of Financing and Incentives / Efficiency of Funding                                   | Efficient financing (street, parking, insurance, fuel, etc.).                                  | 1 Investment Cost Efficient   | Operating efficiency  | Development of Low Cost   |
| Economic Efficiency and Energy                       | 2 Rates Transportation (Transportation Cost Offers)                  | Maximize cost efficiency and affordability Cost   | Transport rates Inexpensive and Affordable   | 2 Low Operating Costs and Care Easier                                       | Energy efficiency   | Low Operating Costs and Care Easier   |
| Efficiency of Transport Operational                  | 3 Affordability and Availability                                     | The entire population can be affordable in accessing basic services and activities (essential). | Walk distance (distance between stations) adequate availability of transportation all the time | 3 Capacity and Reliability Services   | Community development   | The ability to pack, a carrying capacity in peak time and excellent service                   |
| Productivity, operation and Transport system service | 4 Travel Time, Frequency and Headway                                 | Transportation System Efficiency  | Schedule adequate, high travel speed, high frequency   | 4 Cycle Speed   | Transportation System Efficiency  | Schedule adequate, high travel speed, high frequency  |
| Economic Development                                 | 5 Flexibility (Easily Accessible and Switching Modes)                | Transport System Integration  | Availability of facilities Transfers between Moda, Moda Ease Synergy with Other Modes          | 5 Advantages Provided by (Rapid Return on Investment)                       | Economic productivity   | Rapid Payback Period, Facility Expansion  |
| STAKEHOLDER  | REGULATOR  |   |  | SOCIETY   |   |   |
| OBJECTIVE OF SUSTAINABILITY                          | CHOSEN CRITERIA  | TARGET  | BENCHMARK  | CHOSEN CRITERIA   | TARGET  | BENCHMARK   |
| Economic Productivity                                | 1 GDP per capita per Capacity Mode                                   | Transportation System Efficiency  | Estimates Increased GDP per capita as a result of development of transport infrastructure      | 1 Allocation of expenses for transport (efficiency in the Use of Transport) | Financing and incentives Efficient / Efficiency Funding   | Efficient financing (street, parking, insurance, fuel, etc.).                                 |
| Economic Efficiency and Energy                       | 2 Efficient Implementation System and Funding                        | The efficient operation and management of assets  | The use of government resources and the community are minimal                                  | 2 Minimizing Fuel Consumption Per Capita Imports                            | Congestion Cost Reduction and Energy Wastage  | Reduce the use of road space and the use of fossil fuel                                       |
| Efficiency of Transport Operational                  | 3 Supporting the Local Industry                                      | Business and economic development   | Use of local content in the process of development and operation                               | 3 Affordability and Availability  | The entire population can be affordable in accessing basic services and activities (essential). | Distance Walk (distance between station) adequate availability of transportation all the time |
| Productivity, operation and Transport system service | 4 Congestion Cost reduction per capita                               | Congestion Cost Reduction and Energy Wastage  | Reduce the use of road space and the use of fossil fuel  | 4 Congestion Cost reduction per capita                                      | Congestion Cost Reduction and Energy Wastage  | Reduce the use of road space and the use of fossil fuel                                       |
| Economic Development                                 | 5 Supports Regional Economic Improvement                             | Community Development, business and economics   | Acceleration of regional development   | 5 Ease of Access (Easily Accessed By Users Nor Not Good)                    | Transport System Integration  | Availability of facilities Transfers between Moda, Moda Ease Synergy with Other Modes         |

This analysis was performed for all parameters include parameter economic, social, environmental and operational technical also all the actors involved (users, operators, regulators and society)

## 5. Conclusion

Based on these results, the use of criteria is limited to only one type of criteria for all stakeholders (with different interests) less able to describe and interpret the desire of each of the actors involved. Through a process conducted in this study were carried out gradually and systematically, it can produce criteria that meet the goals and objectives to be achieved by each actor.

Determination of criteria for becoming a crucial thing, because making mistakes parameters, criteria and indicators will have an impact on the results of studies conducted.

## References

- [1] Bappenas, “ The Study on Integrated Transportation Master Plan for Jabodetabek Phase 2 “, *Final Report*, National Development Planning Board (BAPPENAS), Republic of Indonesia, 2004
- [2] Litman, “Developing Indicators for Comprehensive And Sustainable Transport Planning “, Transportation Research Record 2017, *Transportation Research Board* (www.trb.org), 2007, pp. 10-15. 2007, Download at 10 October 2015,
- [3] Macharis, Cathy et. al, “ Multi Actor Multi Criteria Analysis (MAMCA) as A Tool to Support Sustainable Decisions: State of Use “, *Journal of Decision Support Systems* 54 (2012) 610–620, 2012
- [4] Tamin, OZ, “ Transportation Planning and Modelling” , Edition 1, *ITB Bandung Publisher*, 1997
- [5] Vuchic, Vukan R, “ Urban Transit : Operations, Planning and Economics “, *John Willey and Sons*, Inc, New Jersey, 2005