

## FUTURE CITY BASED ON SMART MOBILITY CONCEPT : CHARACTER AND BENCHMARKING

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**Abstract** - A city in overcoming its problem is defined as a smart product known as the smart city concept. Smart city has a conceptual definition as a city that is anticipatively able to manage resources in an innovative and competitive manner, with technological support in order to create a city that is comfortable and sustainable. One of the dimensions in smart city is smart mobility (transportation and infrastructure): Management of urban infrastructure that is developed in the future is an integrated and oriented management system to ensure alignments with the public interest. This study uses a critical review approach with a descriptive analysis method which is carried out by examining an urban problem in general and the theory of smart city through the search for ideas in the literature with the focus of this research is to define the character of smart mobility so that from defining the character, a solution is obtained about the indicator and expectations that are fulfilled to realize a city that has a smart mobility character. Through these methods, characters are generated from a smart city that is responsive, innovative and competitive. From these criteria produce a matrix to explain smart mobility consisting of aspects concerning aspects of less mobility, move freely, and less travel time. From the existence of the character and the matrix is finally cascaded to an indicator of the benchmarking toward smart mobility of a city.

**Keywords:** Smart Mobility, less mobility, move freely, and less travel time

### 1. Introduction.

City is a network system of human life characterized by high population density and colored by heterogeneous socio-economic strata and materialistic features. Or can also be referred to as a cultural landscape caused by natural and non-natural elements with symptoms of population concentration that is large enough with a heterogeneous and materialistic pattern of life compared to its back regions (Iwan and Nia in Prof. Bintarto, 1983). Talking about the city certainly does not escape the problems that plagued the life of a city. This problem involves various aspects of physical, social, cultural or economic. In the course of the city population growth itself now reaches more than 50%, this is due to the people's preference to living in urban areas. This phenomenon cannot be ignored causing a level of city density that exceeds its capacity, which provides an externality for the decline in life in a city. From these questions in this era began to emerge various city concepts such as green city, garden city, and which is still intensively discussed, the city as a smart product to overcome urban problems called the smart city concept.

"Smart city" has a conceptual definition that is a city which is anticipatively able to manage resources in an innovative and competitive manner, with technological support in order to create a city that is comfortable and sustainable. Smart is defined here as an accuracy but it is a matter which is not based on technology, although there are elements of technology but only as a supporting tool to realize smart city. To create a smart city, Boyd Cohen defines 6 indicators or dimensions that measure the achievement of a smart city, namely: a) Smart Living b) Smart Environment, c) Smart Utility, d) Smart Economy, e) Smart

Mobility and f) Smart People. By focusing on the element of mobility that is smart mobility, the management of urban infrastructure developed in the future is an integrated and oriented management system to ensure alignments with the public interest (Lazaroiu and Roscia, 2012). In this case the infrastructure has an important role on the quality of a city, with the existence of an ideal infrastructure, will have an impact on improving the life quality of city population, followed by economic growth and social welfare. Smart Mobility comes from the words smart and mobility, before discussing further about smart mobility here are some definitions of mobility taken from two international dictionaries.

**Table 1.** Definition *Smart* Mobility

Source	Definition	Keywords
Cambridge Dictionary	<i>The ability to move freely or be easily to move</i>	<i>Move freely</i>
	<i>The movement of people in a population, as from place to place</i>	<i>Move, place to place</i>
	<i>city where it is easy to get from one place to another, with an innovative and efficient system of public transport that promotes the use of vehicles with low environmental impact, which regulates access to historic town centres, and makes them more liveable (pedestrian walkways).</i>	<i>Easy to get from one place to one place</i>
Boston University	<i>The manner in which people are able to move around in the environment in order to participate in the activities of daily living and, move from place to place. Movement include standing, bending, walking and climbing.</i>	<i>Move around</i>

Departing from the definition of mobility above, smart mobility has the following definitions: Smart mobility (transportation and infrastructure): Management of urban infrastructure developed in the future is an integrated and oriented management system to ensure alignments with the public interest (Lazaroiu and Roscia, 2012; Permana, Soetomo, Hardiman, and Buchori, 2013). A different understanding of smart mobility is as a meeting of transportation needs between people and goods, which involves economics, the environment and human resources: (Green California Summit and Exposition, 2009).

## 2. Methods

This study uses a critical review methodology which is carried out by examining an urban problem in Bali in general and theories about smart cities through the search for ideas in the literature with the aim of formulating theoretical and methodological contributions. The focus of this research is to define the character of smart mobility so that from defining the character, a solution is obtained regarding the indicators and expectations that are met to embody a city that has a smart mobility character. The nature of this research is descriptive analysis, which is the regular breakdown of theories and data that have been summarized, then makes the character of smart mobility based on this understanding. After formulating the criteria, the next step is to formulate indicators and solutions in creating smart mobility.

## 3. Results and Discussions

### 3.1. Smart Mobility Character

The development of the tourism industry in the province of Bali, resulting in the direction of the urban growth which is more inclined in the South Bali region led to a concentration of population levels which reached 30.69% of the total population in Bali and population growth which reached 1.89% and surely the occurrence of socio-economic concentration which causes concentration of growth in the orientation of the employment sector. The impact of the centralization will certainly cause problems in the transportation sector, the explosion number of motor vehicles is a trigger for transportation problems because of the addition of 3.6% of roads per year which is not comparable to the increase in the number of motor vehicles reaching 14% per year. In addition, the problem is also caused by transportation facilities that are still very limited and the increasing use of land which has an impact on the rising and trip generation as well as mixed land use.

1. The growth of motor vehicles continues to increase
2. Unbalanced growth between road network segments (3.6%) compared to vehicle growth (14%)
3. Inadequate road capacity results in suboptimal road functions caused by: street vendors, spilled markets.
4. Transportation facilities are still limited such as: shelters / bus stop, and road equipment facilities (signs and road markings).
5. The number of intersections with short distances.
6. The increasing use of land which causing the increasing of trip generations as well as mixed land use

Regarding to these problems, an operational measure is carried out by applying the definition of smart mobility to transportation problems. Through this definition is cascaded to an operational definition that provides directly about the criteria or character of a smart city, each of which has the following meaning:

1. **Responsive** means a mobility system that is able to meet the needs, desires and expectations of the actual movement of its users.
2. **Innovative** means a mobility system that enables effective and efficient movement.
3. **Competitive** means a mobility system that provides many travel options.

The following is an overview of the steps in the formulation of the smart mobility character.

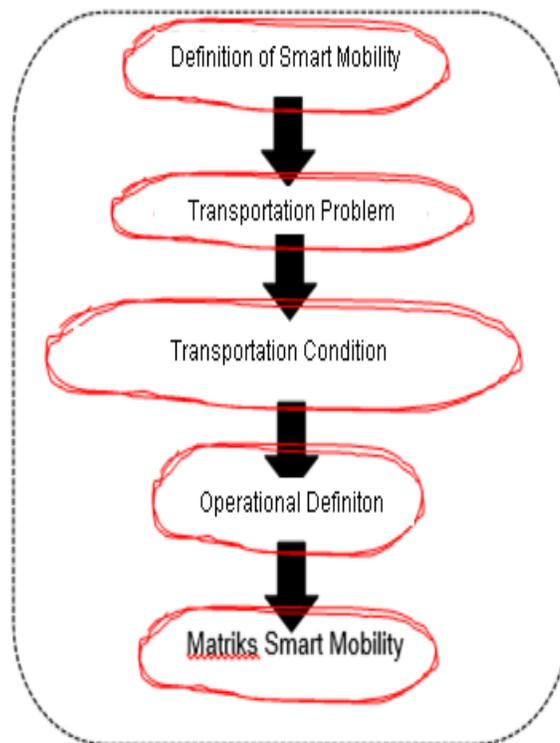


Image 1. Smart City Formulation

Based on the thought about the flow above, a matrix was drawn that described an initial state as an effort to create a smart city. This matrix serves as a preliminary guideline for the formulation of indicators and future expectations regarding smart mobility steps. The following is a matrix formed through the study of definitions and conditions and transportation problems shown in table 2.

Table 2. Smart Mobility Matrix

Aspect	RESPONSIVE	INOVATVE	COMPETITIVE
	Mobility system that is able to meet the needs, desires and the actual movement expectations of users	Mobility system that allow the effective and efficient movement	Mobility system which quantitatively and qualitatively optimal
<b>Less Mobility</b>	Movements with the lowest average daily travel distance	Systems or technologies that reduce daily movement or shorten the distance of daily trips	
<b>Move Freely</b>	Movements with the highest level of ease as possible	A system that provides a choice of modes and route of movement	A system that allows the highest possible level of mobility
<b>Less Travel Time</b>	The average daily travel time is as short as possible		A system capable of reducing daily travel time to be as short as possible

In the less mobility aspect, it gives the sense that a movement made must have the lowest average daily distance that is intended so that the distance needed to reach a connected location is within close range or as far as 0 meters. The move freely aspect gives an indication that an ideal mobility is a movement that provides diverse alternatives and there are no obstacles that interfere with a movement. The last aspect is less travel time which has the understanding that, to achieve a movement from one location to another requires a minimum travel time so that an effective and efficient use of the transportation mode will be achieved.

### 3.2. Smart Mobility Indicators and Expectations

In compiling the indicators of a smart mobility is an imagination process of the hopes and dreams of what is imagined about the city of dreams. In the case of smart mobility to assist in the preparation of an indicator, we must also dream of a state of transportation that we dream of in the future, however this is not dreaming as broadly and freely as possible, but rather limiting the definition and matrix that have been prepared previously concerning aspects of the less mobility, move freely, and less travel time.

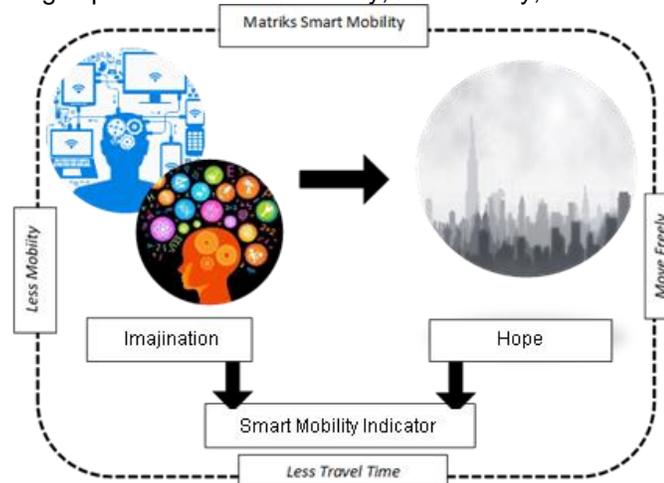


Image 2. Formulation Step of Smart Mobility Indicator

Smart mobility is an urban mobility that involves 3 aspects, which are less mobility, move freely and less travel time to make it happen. Regarding to this, the shadow about smart mobility is an efficient city by involving it when doing traveling activity.

### A. Less Mobility

The expectation of less mobility is that in a smart city, residents of a city do not need to make a move that takes long distances to reach their desired destination. Even in a smart city, it is also possible for residents to move close to 0 km to do something and fulfill their needs. From this statement we can also conclude it as a concept of live, work, and play in one place, in the sense that all activities we do are centered on only one place so that the commuting trip of the average person per day will be reduced. The following is an overview of the expected less mobility.



Image 3. Live Concept, work and Play in One Place

Closeness in reaching the intended distance is part of smart mobility in the sense that we are and live in an environment where everything we need or want has a short distance so that we do not need to go far to find it.



Image 4. Less Mobility Illustration

### B. Move Freely

*Move freely* is defined as freedom in making a movement, in addition to make a free movement, it is necessary to have available modes and travel routes with minimization of obstacles. Moving freely can be likened when someone will move from one place to another that assuming to reach one's destination has a choice of modes of travel such as biking, walking or using public transportation. A smart city certainly provides high accessibility with evenly spread outreach areas. With move freely movement can be:

1. To reach the destination location is free to use any route or mode
2. All destination locations can be reached easily without exception
3. No obstacles encountered on the way
4. Free to determine the time of departure if you want to ride any mode

The freedom of movement certainly has a positive effect on the transportation of a city. With a hope that reaching a strategic location is easy even on foot. Talking about obstacles, of course we have thoughts

about congestion, traffic congestion and road improvement. In a smart city, these obstacles are something that must be minimized in the movement process, because an obstacle will have an impact on the limitations of travel choices and the time to destination. One hope in reducing barriers by taking an example in the case of pedestrians, in this case pedestrians are given a special path that makes them feel safe and comfortable to walk in any condition, here is an overview of move freely.



Image 5. Illustration of *Move Freely* (above) and a downward way for pedestrian (below)

### C. Less Travel time

*Less travel time* has the understanding as a reduction in travel time to reach the destination/goals. This is certainly an important element in the formulation of an ideal movement. Everyone wants time to be in accordance with the distance and availability of the available modes. Assuming that people make a move from point A to point B with a certain distance must be reached with the ideal time or as short as possible. To achieve a transportation condition that lacks travel time, there are 3 points that need to be taken into account in order to realize the expectations of transportation conditions that have less travel time;

1. Having good reliability, both departure and arrival hours for public transportation modes
2. The average speed of transportation in urban areas is at least 40 km / hour
3. There is an innovation about transportation that can make the transfer quickly or even express

With the hope of fulfilling these three things, the time of reaching from one location to another can be reached in the shortest possible time. Especially in the reliability of modes and the presence of investments that accelerate a good movement in the form of land, sea and air transportation. The following are examples of effective and efficient transportation that have been implemented to reduce travel time.



**Image 6.** Express train and Commuter

With a picture that in the future it will create a transportation condition that has an elegant element in its movement, and can provide comfort and effectiveness in the operation of the train. This transportation condition is an ideal transportation condition that is expected by every city in the world.



**Image 7.** Expectation of Less Travel Time Transportation

### 3.3 Smart Mobility Indicator

At this stage is the final stage in the formulation of a smart mobility achievement which is a benchmark in terms of what must be met in order to achieve a smart mobility as one of the six components of smart city. With the expectations regarding aspects of smart mobility consisting of less mobility, move freely and less travel time that there are measurements used to measure the mobility of a city. This measurement will be made in a tabular form that connects the variables that affect the three aspects which are then searched for an ideal condition that acts as a benchmark against these variables. The following is an indicator table in the formulation of a smart mobility.

Table 5. Smart Mobility Indicator

Criteria	Aspect	Benchmark
Responsive	Move Freely	The availability level of public transportation modes is 90% of the transportation modes user number
		The availability level of alternative route
		The perception of comfort level above 90%
		Optimal condition of transportation physical condition
		Accident per 10.000 of the population
Inovative	Less Mobility	Average daily distance of traveling is less than 2 km
		20% of the city population use non-motorized transportation
	Move Freely	Traveling information availability level is above 80%
		100% public transportation is managed by government
	Less Travel Time	The average daily travel time is less than 20 minutes
		Have an average speed of at least 40 km / hour

The preparation of this indicator is expected to be the first step for a city to measure how smart the level of urban mobility is. In addition, this indicator is also used to measure the gap that occurs between the existing conditions against the expected conditions aimed at the realization of a responsive, innovative and competitive mobility to an urban condition.

#### 4. Conclusions

*Smart Mobility* has a definition as a city with a movement system that allows the goals achievement with as little movement as possible. An operational definition that provides directly about the criteria or character of a smart mobility, each of which has the following meaning:

1. **Responsive** means a mobility system that is able to meet the needs, desires and expectations of the actual movement of its users
2. **Innovative** means a mobility system that enables effective and efficient movement
3. **Competitive** means a mobility system that provides many travel options.

From the results of these characters, it can be defined indicators of achieving a city smart mobility is as follows:

- *Less mobility* indicators consist of an average daily travel distance of less than 2 km and 20% of city residents use non-motorized transportation.
- *Move freely* indicator consists of the availability level of public transportation modes, which is 90% of the mode of transportation number user, the availability level of alternative routes, the optimal physical condition of the transport fleet, accident cases per 10,000 population.
- *Less travel time* indicator consists of an average daily travel time of less than 20 minutes and has an average mode speed of at least 40 km / hour.

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