

# The 3E's of Sustainability Establishing a Measure of the Success Rate of Urban Smart Growth

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**Abstract:** In order to achieve sustainable development planning goals, many cities are implementing smart growth plans. We use the 3E's objective of sustainable development as the basis for analysis. And we establish model to make a comprehensive evaluation. and we define the metric of success rate of urban smart growth, thus we get the evaluation standard.

**Keywords:** Urban smart growth, Sustainable Cities, the 3E's of sustainability, Principal Component Analysis

## 1. Introduction

Since the 20th century the 60's, with the deepening of urban suburbanization, the review of 'Urban Sprawl' has attracted more and more attention from the public. 'Urban Sprawl' mainly refers to the urban space of low-density expansion. In this process involved agricultural land, the transformation of open space to construction land, and with a series of economic, social and environmental problems. Cities are the main bearers of the future population and economy, representing the occupation of land, energy consumption, resulting in the main environmental pressure. It is estimated that by 2050, the urban population will reach 66% of the world's total population.

Smart growth is a kind of urban planning theory originated from the 1990s, that means under resource constraints, through the realization of social, environmental, and economic balanced development, Optimize the urban structure. Its goal is to curb the continued urban sprawl and the loss and reduction of urban-centered surrounding farmland, which is a city growth policy to address urban sprawl. Therefore, the sustainable construction of the city becomes more and more important. [1,3,4]

## 2. Model assumptions

We need to choose two cities which both the population is 10 million to 50 million in different continents Next, we make the following assumptions to define an metric that measures the success rate of urban growth.

- ① Ignore the impacts of the extreme disasters.
- ② Ignore the impacts of the migration of population

## 3. Factors selection

we describe and analyze the factors that affect this growth from different development perspectives, and use the following metric to evaluate the degree of the development.

Table 1 City smart growth evaluation of the indicators

level I indicator	Level II indicators	Level III indicators
To achieve smart growth in the city	Economic prosperity	(Per capita GDP ( $x_1$ ))
		The total retail sales of social consumer goods ( $x_2$ )
	Social equality	unemployment rate ( $x_3$ )
		Gini Coefficient ( $x_4$ )
	Environmental sustainability	Per capita green area ( $x_5$ )
		Unit GDP energy consumption ( $x_6$ )



$$W(t) = \frac{Z(t)-Z(t-1)}{(1+\alpha P)(1+\beta Q)} \quad (6)$$

Among them,  $\alpha$  is the annual population growth rate adjustment system,  $\beta$  is the annual growth rate of urban area adjustment factor.

● **Standard division**

Through the data processing, we divided the following criteria to determine the extent of the city's smart growth

Table 2. The classificatory standard

level	W	Smart growth situation
I excellent	>3.8	To meet the requirements of smart growth
II good	3.6~3.8	the success rate of smart growth basically meet the requirements, there can be improved
III medium	3.4~3.6	There are many problems in Urban Smart Growth
IV poor	<3.4	Urban smart growth is poor

## 5. Conclusions

Smart growth focused on urban construction particularly emphasis on sustainable economies. we can provide a simple idea for the construction of urban smart growth. "Smart growth" is a comprehensive strategy that covers the principles of urban development at multiple levels.

We use Principal Component Analysis to obtain the main components, which reduces the factors which needed to consider. And using the principal component analysis method to obtain the comprehensive score as a city comprehensive score, at the same time, with the urban development of the overall score of the increase in the amount of time as the city smart growth score. Fully explain the growth of this change in indicators. Not only for the development of the same size of the city, for the development of different sizes of cities can also be compared.

When defining the success rate of smart growth of a city, we take into account that urban growth scores and urban area and population growth, which makes the results more accurate.

## 6. References

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