

## A Study on Smart Growth

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**Keywords:** Smart growth; Four E's; Sustainable cities; AHP

**Abstract.** With the continued urban sprawl, numerous community planners promote the idea of smart growth, an approach to direct development in a long-range, sustainable way. Combining the concepts of the three E's of sustainability and 10 accepted principles, we put forward our theory of four E's of sustainability.

First, we formulate a metric to measure smart growth of a city. We determine the weights of four E's and initiatives via AHP. Then, we score plan policies according to how specific the initiative states in words. Finally, we sum them up by weight, getting the aggregate score of a plan. Then, we choose Jia Yuguan in China and Long Beach in the United States for further study. We find the policies dealing with economic prosperity score higher in Jia Yuguan. And the policies in Long Beach fund for solving housing problems seem to be more effective. Finally, on a basis of the geography, expected growth rates, and economic chances, we propose new growth plans with the detailed reason. With our metric, redesigned urban plans score higher than before, which validates that refined plans meet the smart growth to a larger extent.

### Introduction

Recently, rapid urban sprawl poses a series of new challenges for regional planners both globally and nationally, including economic prosperity, social equality, and environmental sustainability. Smart growth is a current way to combat these problems.

Smart growth is a multifaceted approach to urban development, which covers a range of development and conservation strategies that help protect our health and natural environment and make our communities more attractive, economically stronger, and more socially diverse.

The nucleus of the smart growth is build a more economically prosperous, socially equitable, and environmentally sustainable city or town. The smart growth has ten principles and three E's.

When the governments apply these principles, they should take the demographics, growth needs, and geographical conditions of a city into consideration, helping they adhere to the three E's.

### Smart Growth Evaluating System

**Extend Three E's to Four E's.** Referring to the related literature, we find that the smart growth is designed to prevent urban from continued sprawl. And we understand the meaning of smart growth from two aspects—"smart" and "growth".

If a city lags behind, with a slow development of economy and democracy, obviously, it is not a "growing" city. Thus, it doesn't conform to the smart growth. Meanwhile, if a city is booming, while it has a poorly planned development, leading to jam, air pollution, less green space, there is no doubt that this city is "growing" but not "smart", so it also doesn't meet the smart growth principles.

After carefully reading the three E's of sustainability and the 10 principles of smart growth, we conclude that they overlap each other. Meanwhile, there are also some differences between them. The former don't consider the poorly planned development, while the latter don't mention economic prosperity.

Taking them together, we decide to extend our evaluation from three E's to four E's, which is short for economic prosperity, equal society, environment sustainability and effectiveness of land

uses( shown is Fig. 1). And we think that economic prosperity and equal society are connected to “growth”, while environment sustainability and effectiveness of land uses relate to “smart”.

Then we would like to state the detailed meanings of four E’s of Sustainability.

### Implications for Four E’s of Sustainability

**Economic Prosperity.** Economic prosperity is the increase in the inflation-adjusted market value of the goods and services produced by an economy over time.

As we all know, economic prosperity plays a significant role in a city’s economic index, but only using GDP in unit land area to measure a city’s economic development is absolutely not enough. Therefore, to make our metric more accurate, we take urban retail sales into consideration as well, which estimates economic growth from another angle.

In a nutshell, in our model, GDP in unit land area and urban retail sales determine the economic growth of a certain city.

**Equal Society.** The equal society here especially means social justice, in other words, it is the fair and just relation between the individual and society. This inequality makes a difference between high-income people with low-income people.

In order to reduce social inequalities, we tend to improve the employment rate, and build plenty of houses for families of all life stages and income levels.

Our algorithm contains four aspects related to equality. The first one is employment rate, and a high employment rate represents that people of all life stages have opportunities to show their abilities and achieve their dreams. The second one is the housing stress. The third one is providing a range of housing opportunities and choices. The last one is encouraging community and stakeholder collaboration in development decisions.

**Environment Sustainability.** Environment sustainability refers to physical and cultural settings. In this part, we apply two elements to examine environment sustainability. Environmental contamination: We mainly consider the air pollution; the total area of green space and farmland.

**Effectiveness of Land Uses.** Effectiveness of land uses includes mixing land uses, urban sprawl and the quality of transportation (we just consider public bus services).

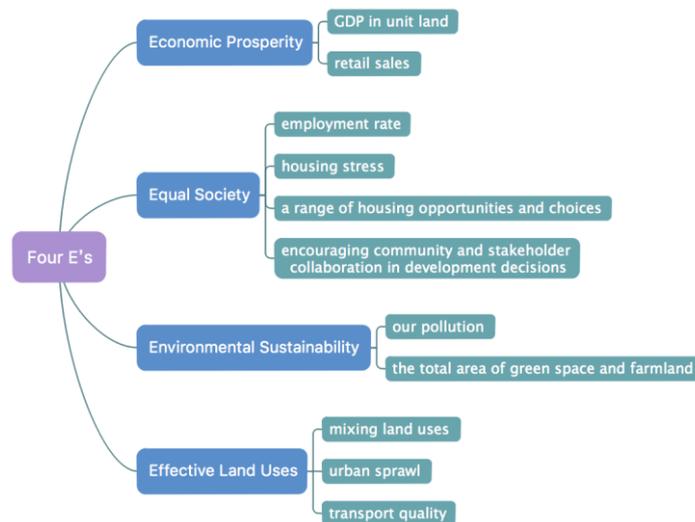


Figure 1.

**Determining the Weights.** To make our metric more accurate, we invite several social experts to help us determine the weights of four E’s and each initiative via AHP (Anarchically Hierarchy Process). Those social experts have a thorough understanding of the recent condition of a city. According to the population, environment, economy, social environment and land planning of a city, experienced experts score the final weights.

**Evaluating Smart Growth.** Aiming to determine the success of smart growth of a city, we rate initiatives according to the extent that initiatives embrace the four E's.

We classify these initiatives into six grades. Then, we count them up by weight, working out the aggregate score of a plan. The calculating process is shown below:

$$G = \sum w_i s_i \quad (1)$$

## Discussion on the Current Growth Plan

In this task, we choose Jia Yuguan that located in China and Long Beach that located in the United States for further study.

### (1) Jia Yuguan

Using our metric, the current growth plan of Jia Yuguan scores 20.26, which is not very high or low.

Since Jia Yuguan is uneven developed and not all-round developed, promoting commerce in the poor regions helps a lot, which improve the scores. Additional, because environmental protection in Jia Yuguan is complete, it is not necessary to strengthen environmental protection. Thus, the initiative related to improving environment is relatively low.

Based on the 10 principles of smart growth, we make an overall analysis on the current growth plans in the selected cities.

### (2) Long Beach

Long Beach is a booming city in the United States, where culture and education develop pretty well. And its core businesses are port, tourism, petroleum and manufacturing.

Although Long Beach is economically developed, the gap between the poor and the rich can't be ignored. The poor are mainly gathered in shantytowns. Due to the developed industry, Long Beach also faces a great environmental pressure.

Applying our metric, the current growth plan scores 16.8760.

On the one hand, among all the initiatives, the initiative—"Create additional recreation open space and pursue all appropriate available funding to enhance recreation opportunities." scores lowest. This policy attempts to improve the community public entertainment space, but it does not contain detailed projects. And this initiative is of little help to the existing challenges (environmental problems, the large gap between the rich and the poor, housing problems) in Long Beach. As a consequence, this initiative scores lowest.

On the other hand, the initiative—"Improve the quality and availability of housing by addressing declining homeownership, neighborhood stability and overcrowding." scores highest. This policy explains how to ease housing problem in the center town in details. It also suggests the government fund for the poor to buy houses, perfectly solving the housing problem and narrowing the gap between the rich and the poor.

## A Growth Plan

**A Growth Plan for Jia Yuguan.** According to the current policy, we find that the economic structure of Jia Yuguan is too simple. Therefore, our development plan adds the following four items on basis of the existing policy.

**Improve the Public Transport System.** Building plenty of highways results in a fast urban sprawl, thus, it is a wise way to improve the public transport system. The government should give more priority to the development of public transport.

Since its complex geography, it is not a wise choose to build more subways in the town. Hence, we suggest the administrators put more emphasis on refining bus system. Here we state some specific growth plans:

Invite some road designers to draw a more rational design of traffic lights and signs, since transport facilities play a vital part in increasing transport efficiency. Additional, this plan can improve security of public transport.

Enhance the image of the system and improve security.

Put forward a better maintenance regime with a hotline for reporting faults and damage.

**Move factories to the edge.** Firstly, based on the information we have collected, we find that the population growth rates are high in Jia Yuguan.

Secondly, due to its special geography, Jia Yuguan has abundant mineral resource. Therefore, it has many iron and steel industries. From the map below, we can see that the most of industries are located in the center of the city, and they occupy a large range of areas.

Combining above factors, we can predict that in the next few decades, it is more difficult for residents to find a place to live. So we plan to move some factories from the center of the city to the edge of the city, as well as encourage the related personnel to build factories outside the boundary.

**Stimulate the development of the retail.** Jia Yuguan has a booming iron and steel industry, while the retail is undeveloped. So we suggest the **government** to stimulate the development. At the same time, this policy adds some economic opportunities.

**Speed up the development of new areas.** Based on the geography of Jia Yuguan, a small range of areas in the south of the map is undeveloped. In order to provide more livable places, we plan to speed up the development of these new areas. This project also benefits for economic opportunities.

**A Growth Plan for Long Beach.** Since there are many factories around the Long Beach, the air pollution here is very serious.

Besides, although the population growth rate in Long Beach is small, the population base is large, which means a low growth rate may lead to a large population. Thus, residential area, commercial district and industrial estate cover a large area of the land, resulting in a lack of green space.

What's more, poor people are mainly gathered in shantytowns, widening the gap between the poor and the rich. Meanwhile, it reminds us to emphasize on social equality.

Regarding all current situations, we add the following plans on basis of the existing policy:

**Reduce Air Pollution:**

Make full use of the non-pollution energy, like solar energy.

Improve emission standards.

Reduce vehicle emissions by raising fuel quality standards.

**Enlarge Green Space:**

Conduct more propaganda campaigns of the environmental protection to improve the environmental awareness of citizens.

Encourage people to plant more trees.

Build several roof gardens, where people can grow vegetables and some attractive plants.

**Increase Social Equality:**

Encourage the poor to live more dispersedly.

Create wealth in poor mountain areas by increasing labor demand in the relocated areas.

Provide a moderate amount of financial subsidies according to the policies and regulations.

**Evaluating the Success of Our Smart Growth Plans.** We calculate the score of smart growth in Jia Yuguan and Long Beach, and then we compare them with the original plan.

1. Jia Yuguan

Stimulating the development of the retail wins the highest score. This result is reasonable, because the economic structure of Jia Yuguan is too simple, iron and steel industries are core industries in Jia Yuguan. Thus, developing retail is good for economic diversification, and helps economic boom. At the same time, this policy offers more employment opportunities, which conforms to mixing land uses.

Long Beach

Building several roof gardens wins the highest score. Based on our previous study, we know that Long Beach has a booming economy but a little green space. There is no doubt that roof gardens increase the green space, embracing the environment sustainability. Besides, it conforms to the first principle —“mix land uses”. What's more, it can provide more employment chances, according with social equality. In a word, this is an excellent approach.

## Conclusion

Based on AHP, we create a four E's evaluating system to measure the success of smart growth of a city. Applying our metric in Jia Yuguan and Long Beach, the former one gets 20.26, and the later one gets 16.87. The result proves that a more detailed plan can increase the success of smart growth to some extent.

Next, to make the planning more effective, we add several initiatives to the original plan, according to the geography, expected growth rates, and economic chances. To our delight, redesigned urban plans score higher than before, and it reflects that principles should be tailored to a community's unique needs.

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