Urban Sustainability Issues of Chinese Small Cities:
Case Study of Keqiao, a Representative SMEs-driven Small Town in Southeast China

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Abstract:

China is now experiencing rapid urbanization. According to United Nation's Global Report on Human Settlement 2001 (HABITAT 2001), China's level of urbanization will go up from 32.1% in 2000 to 50.3% in 2030, and China's urban population will increase from approximately 0.41 billion to 0.75 billion in 30 years. The more than 19,000 small cities and towns in China are, and will keep on, acting as the major receiver of this population transfer. And obviously, this urbanization process has been causing ever increasing pressure on those cities' urban infrastructure, energy production and supply, resources supply, urban and regional environment, and also on cultural and social issues, such as cultural heritage conservation, social equity, and so on. How the Chinese small cities and towns react to these various challenges will have important regional and further global impact on the environment and the overall sustainable development of human beings, considering those cities' large quantity, fast development and their economic potential.

In this paper, we chose Keqiao as our case. It is a typical actively-developing small town in southeast China with representative SMEs(small- and medium-sized enterprises)-driven economy model, typical industrial structure, as well as a characteristic long history and valuable cultural tradition. We discussed the multi-dimensions of sustainable urban system, including economy, environment, society and urban life. Based on the case study, we went further to discuss the challenges of urban sustainability and corresponding strategies to address these challenges, specifically considering the characteristics of the SMEs-driven small cities and towns in developing countries with similar situation and on similar level as Keqiao in the world city hierarchy.

1. Introduction

1.1 General Situation

> *"The world has entered the urban millennium. Nearly half the world's people are now city dwellers, and the rapid increase in urban population is expected to continue, mainly in developing countries."* [3]
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> *Kofi A Annan, 2001*

As an important part of the developing world, China has been experiencing the transformation from planned economy to market economy. Accompanying this remarkable economic transformation and high-speed development, the GDP of China and the living standard of Chinese people have been

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[3] Kofi A Annan, Cities in a Globalization World – Global Report on Human Settlements 2001 (Foreword), United Nations Center for Human Settlements (HABITAT), Earthscan Publications Ltd., London, UK, 2001.

increasing very rapidly. The distribution of the population in China is also going through a drastic change. Increased industrialization level and labor productivity are releasing people from agriculture, and makes it possible for more and more people to “migrate” into cities to pursue their dreams of better income, better living facilities and information access, as well as better individual development.

1.2 Big Cities vs. Small Cities

While looking at the urbanization process in China in the recent 20 years, we were impressed by two characteristic phenomena. One is the dramatically fast growth of certain big cities, the growth of their municipal area, population, energy consumption and also their environmental impact. Some of them, such as Shanghai and Beijing, have become the so-called “mega-cities” concerning their population and also their regional or even global force of influence. These Chinese big cities are competing for global capital and more importantly for the supreme position in the world city network with other big cities in the Asia-Pacific Rim, say Hong Kong, Tokyo, Singapore, and Kuala Lumpur, and also with big cities in the global range. They have been attracting more and more attention worldwide.

On the other hand, there are also over 19,000 actively developing small cities and towns in China, whose amount, total area and population are increasing even faster than those indices of big cities, though they haven’t caught enough attention yet. This huge number of small cities and towns, as a whole, plays a significant role in the process of urbanization and industrialization in China. They have been acting as the main body of recipient for the population transferring from farms to cities, from agriculture to industry or service during the recent 20 years. We believe, proper development strategies for these large number of widely spread small cities and towns is crucial for the urbanization and sustainability of developing countries, especially those with large populations and large proportion of population in agriculture, such as China and India. The reason is self-explaining. Only relying on several big cities is not sufficient for accommodating the large scale population transfer, and will for sure bring forth a lot of urban problems as well as environmental crisis. Talking about Chinese-styled urbanization and industrialization mode when facing the burden of such a huge population and complicated environmental challenges, how to deal with this large number of small cities and towns as sustainable recipients for population transfer and nodes in regional economic development is quite an essential issue. It is a large and essential piece of the whole picture but has not yet been given enough emphasis.

For small cities and towns, their environmental impact may not be as significant as big cities, when individually observed. However, considering their huge number and also their striking speed of development, this impact as a whole is not at all trivial. Actually it is worthy of serious attention and systematic strategies to deal with.

The typical environmental problems in small cities and towns in China include water contamination, air pollution, hazardous solid waste, etc., caused by the comprehensive effect of sharp augment in urban population, excessive exploit of natural resources, extensive industry structure, as well as the lack of sufficient funds and proper technology in pollutants treatment. These environmental problems are not only restricting the development of certain cities themselves and influencing the living condition of the people residing there, but also exerting negative effect on the regional environment and regional development potential, and furthermore have global impacts. Nowadays, the environmental problems in China have been widely noticed, because we all know that what we are looking at is about 1/5 of the world’s total population and probably the country among those with the highest potential of development in this century.

1.3 Selection of Case

In order to make the discussion concrete and constructive, we chose Keqiao as our case to look at its economic development and the accompanying environmental problems, also keeping in mind its cultural and social changes. Keqiao is a representative small town in southeast China, with characteristic geographic landscape as well as very rich historic and cultural heritage context. Its development since 1980s represents the urbanization and industrialization processes in a large number of Chinese small cities and towns, with typical SMEs(small- and medium-sized enterprises)-driven economy, which was evolved from their traditional industries but is now developing in a different scale. Its development is representative in another sense, that it encounters problems that other rapidly developing small cities and towns are all facing, including quite severe environmental problems and the challenges to develop in a sustainable mode. Urbanization and industrialization are progressing faster in southeast China, where the challenge for sustainable development is also more austere. A comprehensive understanding of their situation makes it possible to work further to approach urban sustainability.

2. Case Study of Keqiao

2.1 Introduction of Shaoxing County

2.1.1 General situation

Keqiao is the central town of Shaoxing County in Zhejiang Province, southeast China. Shaoxing lies close to the east coast near Shanghai (see Figure 1). Shaoxing County has an area of 1,152 Km^2, with an overall population exceeding 724,000 at the end of year 2000. With a subtropical monsoon climate, the area has plenty of sunshine and rainfall. The Guiji Mountains rise in the southern part of the county. The flat land in the middle is characterized by a network of numerous rivers and dotted with many lakes. And in the northern part three major rivers meet to nourish the rice paddy fields. The beautiful aquatic scenes in Shaoxing gained for it the fame as “Oriental Venice” (See Figure 2 & 3).

Figure 1: Geographic Location of Shaoxing County

Shaoxing is among the first 24 cities named as "Famous Historic and Cultural City" in China. It is located within the sphere of the ancient Hemudu Culture, one of the origins of Chinese civilization. Humans began

to inhabit the county area in the primitive society. From the Qin Dynasty to the end of the Qing Dynasty (221B.C. - A.D.1991) Shaoxing had remained a political, economic and cultural center in Southeast China. The county is called "a pearl in the south", "a city of silk", and "a land of culture".

2.1.2 Economic development

The economy of Shaoxing County has been developing at a remarkably high speed in the recent 20 years. Its GDP growth rate has been leading in Zhejiang Province for more than 15 years successively. It has also been listed among the richest counties in China several times, and the county's scientific and technical capacity is the 5th strongest among all the counties nationwide. In the process of its development, the China Textile City located in Keqiao has played an important role. As the second largest specialized wholesale market in China, its total sales of textile and equipments at present accounts for one third of the nation's total. It is also the largest market of its kind in Asia. Keqiao, based on the Shaoxing Keqiao Economy Development Zone, has not only attracted a large amount of investment from outside, but also led to the formation of the district textile industry and one of the most important textile industrial bases in China. On the other hand, the economy in Shaoxing County is characterized by the large amount of small- and medium-sized enterprises (SMEs). Till the end of 2000, there're altogether 21,169 SMEs in Shaoxing with industry production value of more than 48.4billion RMB in the year 2000, which respectively account for 98.2% of the total number of enterprises and 82.4% of the total industry production value in the county in 2000.[4]

2.1.3 Environmental issues

However, accompanying the fast economic development, due to the nature of textile industry and the county's other major industries such as printing, dyeing and wine-making, environment contamination became a serious problem, especially the water contamination in the region. Industrial sewage there contains quite a lot organic pollutants and will further influence the quality of soil and the seas through rivers and groundwater. Additionally, there are also other serious environmental problems caused by the energy consumption structure, and the explosion of urban population and industry.

Though the county has already begun to pay attention to environment protection, the sustainable development of the county and its economy requires more systematic and strategic thinking as well as cogent policy and legislation guarantee.

Figure 4: Location of Keqiao in Shaoxing

2.2 Status Quo of Keqiao

2.2.1 General situation

Twenty years ago, the population of Keqiao was less than 10,000 and its area less than 2 Km^2. While today, it is developed into a town with a population of about 120,000 and the area of more than 12 square kilometers. Its urbanization process has been even accelerated in recent years. From the comparison between the growth

[4] Official website of Shaoxing County, http://www.shaoxing.gov.cn/

of population in Keqiao and the growth of its area, the increase of population appears to be twice of that in the land area, which means the population density doubled in the past 20 years. It's not difficult to imagine the pressure on the environment merely caused by the human residence behavior. Additionally, after moving to town, people are changing their way of living, which results in steep increase in living energy consumption and environmental problems accompanying the consumption. One other alarming sign is that since 1980s, corresponding with the continuous growth of urban population, the area suitable for cultivation within the administrative area of Keqiao has been shrinking apparently.

2.2.2 Economic development

When looking at the industry structure, Keqiao's economy is now mainly depending on secondary industries with assistance of tertiary industries and a little bit agriculture. Regarding the energy consumption structure in Keqiao, coal is the major energy sources with rapidly increasing amount of its consumption, which is shown clearly in Figure 5 & 6.

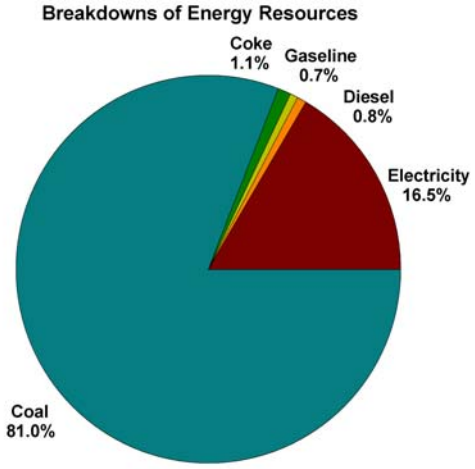

Figure 5: Breakdowns of Energy Resources

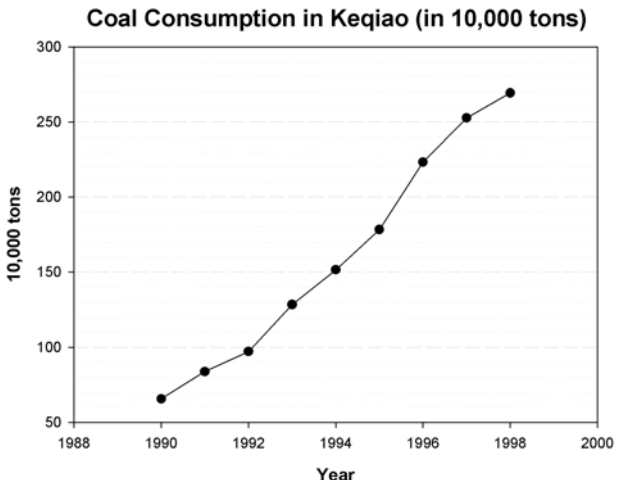

Figure 6: Annual Coal Consumption in Keqiao

In addition, due to the huge demand during the high-speed progressing of urbanization and industrialization, the total consumption of energy and raw materials increased rapidly (for example, see Figure 7 & 8), which left a lot of environmental problems behind because of the improper industry structure and extensive way of production.

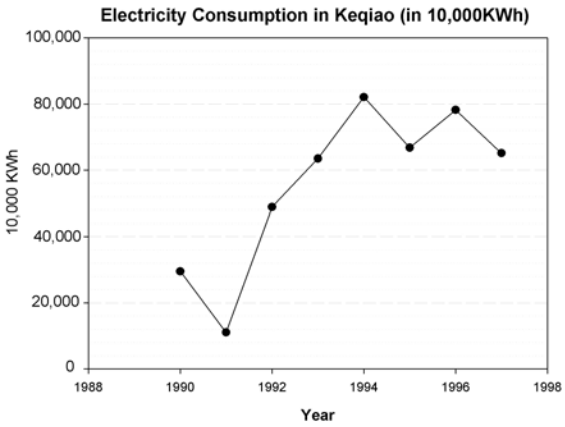

Figure 7: Annual Electricity Consumption in Keqiao

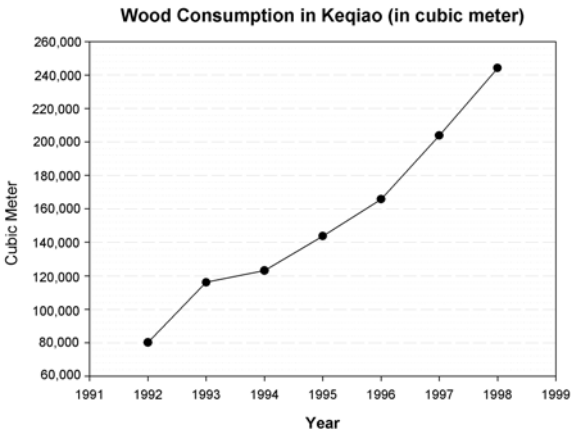

Figure 8: Annual Wood Consumption in Keqiao

2.3 Analysis of Two Major Environmental Problems in Keqiao

2.3.1 Water contamination

Southeast China is famous for its characteristic network of waterways connecting a series of small towns. However, nowadays we're gradually losing this unique landscape and the beautiful scenes because of water contamination. Several major industries happen to be heavily water-polluting. Traditional industries in this area used to be labor-intensive, but is now mechanized, producing in a much larger scale (see Figure 9) and generating tons and tons of sewage containing organic and mineral pollutants every day. On the other hand, the deterioration of water environment is also caused by the rising of the riverbed, because of the soil erosion at the upper reaches of the rivers and also the area along the river. It causes the self-cleaning capability of rivers become weaker and weaker due to less volume and lower current velocity. This is actually a regional environmental problem not only in Keqiao. Most areas in China are now suffering from soil erosion problem at certain degree, especially the northern and western part.

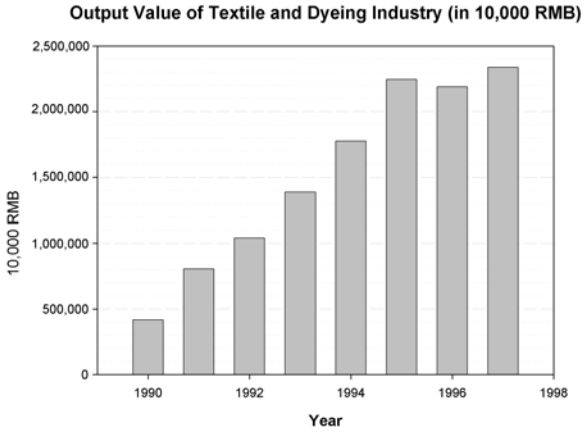

Figure 9: Output Value of Textile & Dyeing Industry

As for the case of Keqiao, the water contamination has following characteristics:

(a) Industrial sewage is the main source of water contamination, among which the most serious problem is caused by the printing and dyeing industries and the paper mills. And the scale of these industries in Keqiao is increasing rapidly since 1990s with important contribution to the economic development of the whole region. The major pollutants in the waterways in Keqiao are the organic matters such as CODmn, CODcr, BOD_5 and DO, which mostly come from printing, dyeing and wine-making.

Most of the factories have only installed simple filtration equipments for the sewage treatment before discharging it into the rivers, and some of them even discharge directly. It's obviously impossible to keep the water environment sustainable in this irresponsible manner. Actually the water quality in the rivers and lakes in Keqiao are deteriorating from year to year. Moreover, other pollution sources, such as agricultural fertilizer contamination, residential sewage contamination and pollution caused by motor-driven fishing boats, etc. are also not trivial.

(b) The water contamination fluctuates seasonally. In autumn and winter, when it is the dry season, the printing, dyeing and wine-making industries are, on opposite, in their busy production season. Thus the water pollution is especially serious at that period of time in the year. That's simply because of the contrast between the large amount of the sewage and the limited self-cleaning capacity of the river. It indicates that special effort should be made at dry season to monitor water quality, and more importantly, more strict and effective control should be placed on the sewage discharge.

(c) The industrial pollution sources are in large number and are widely spread in the whole town according to the urban layout. Water in different waterways are all suffering pollution but at different levels. The problem is especially serious on the banks of the canal in the northwest section of the town where several printing and dyeing enterprises gather.

(d) The over-nutrition phenomenon is common in the network of waterways in the plain area. The algae

and water grass reproduce really fast because of the organic pollutants in the water. Together with the rising silt on the riverbed, they decrease the current velocity or even block the waterway, which drastically reduce the rivers' self-cleaning capacity by dilution.

(e) The safety of drinking water source has been threatened by contamination. And so has the quality of the groundwater source. The production of drinking water will be more and more costly.

2.3.2 Air pollution

The overall atmosphere quality in Keqiao is all right. However, the SO_2 intensity and TSP values have exceeded the standard, mainly because coal is the major energy source for both industry and residence. The following are the detailed reasons:

(a) Industrial exhaust gas

Given the fact that coal counts for 80% of the total energy consumption in Keqiao, the low efficient direct combustion of a large quantity of coal is the ultimate cause of the air pollution in town. Dust and SO_2 are the major pollutants in the atmosphere. Only small proportion of the SO_2 is disposed before discharged into atmosphere (see Figure 10 & 11). The frequency of the acid rain has been increasing from year to year, and it also has the tendency of spreading from city to countryside and even farther. If not controlled properly, the acid rain will cause the acidification of both water body and the soil, and ultimately influence the agriculture in adjacent regions.

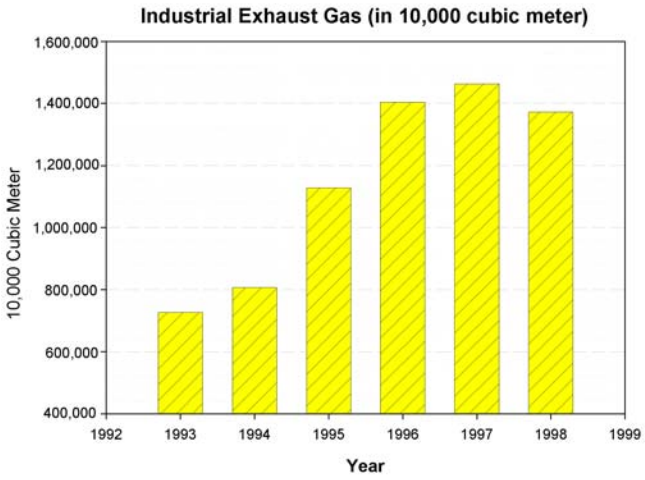

Figure 10: Industrial Exhaust Gas

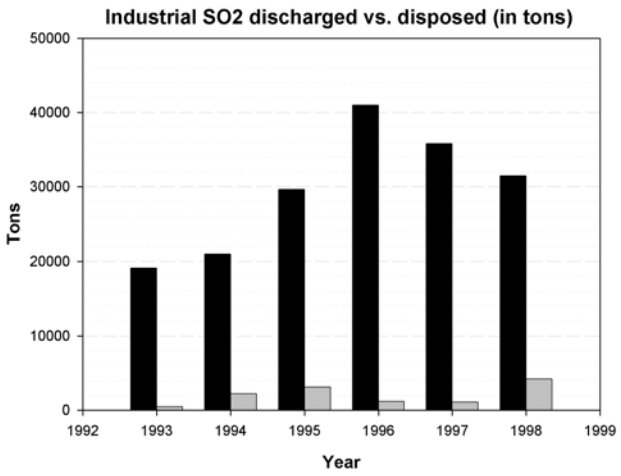

Figure 11: Industrial SO_2 discharged vs. disposed

(b) Low–quality residential fuel

The atmosphere quality of the residential area and mixed land-use area in Keqiao is worse than that in other function areas. This is chiefly because that the residents, especially those living in the old city area are still using "honeycomb coal"，a kind of low-quality coal with very low combustion efficiency. The waste gas subsides close to the ground, and is hard to dilute or diffuse, and thus causes the atmosphere environment quality in residence area especially worse.

Moreover, the exhausts from motor vehicles, second-time dust, etc., are all causes of air pollution, and they are fairly serious in certain districts in Keqiao.

3. Discussion

Based on the analysis on the case of Keqiao, the challenges for urban sustainability of small cities in China, as well as in other developing countries with similar situation, could be discussed in three element

dimensions, respectively ecological, economic and social.

3.1 Ecological Considerations of Urban Sustainability

During the high-speed economic development in China at current stage, it's not surprising to estimate that the excessive exploitation of resources and extensive consumption of energy will still be quite common phenomena nationwide. The efficiency of energy conversion and transmission, and that of utilization are fairly low compared to those indices in developed countries, which will further enlarge the pressure on environment.

Rapid urbanization process has been challenging the sustainability of the urban environment. An urban resident consumes much more, about 10 times the, energy than one living on the farm. Thus the high urbanization rate in China is directly related to the rapid increase of energy consumption. On the other hand, considering the regional environmental pollution, it is possible that the polluted areas will get connected with each other and the negative effects will accumulate, resulting in large scale regional contamination, and finally leading to serious negative influence on global environment.

Water contamination is the most serious environmental problem in Keqiao, and actually also for the whole southeast China. The current situation of the water quality in the network of waterways has already been quite worrying. Besides the direct influence on human life and on industry and agriculture development, since the whole area is characterized for its unique water environment, the continued deterioration of water quality will result in losing geographic and cultural identity of this area, which will definitely hinder the economic development in a long term point of view.

As for the countermeasures, there are certain national environmental protection laws as well asregulations made by local governments concerning the control of pollutant discharge. A series of environmental protection actions have also been undertaken by the Keqiao and Shaoxing local governments to control and reduce the negative impact on the environment by economic development. However, it seems that the current level of monitoring, control and management is not effective enough. The favorable conditions for a faster, healthier economic development and a sustainable urban environment depend on the constant effort pursuing improvement in infrastructure, the "hardware", and legislation, the "software".

3.2 Economic Considerations of Urban Sustainability

As is analyzed, the traditional industry structure and extensive mode of production have caused a lot of pressure on the environment. These issues used to be not so essential when the industry scale was small comparing to the current scale. However, nowadays, when the demands for energy and raw materials, the pollutants and wastes generated from the production process are gradually pushing the capacity of supply and consume of the immediate environment to its limit, we are in a totally different situation.

The contamination could still be on-going because of reasons such as short-term-profit-oriented decision making reality. Actually as far as I know, according to the new industrial structure adjustment plan by the local government in Keqiao, the three proposed major industry categories in this area are decided to be the raw material, energy, and high technology medicine and chemical industry, which could all be potential pollution sources and cause tremendous harm to the environment if not properly controlled. We suppose this plan is made more in favoring the economic returns over the environment.

Keqiao, as well as Shaoxing County and many other rapid developing small cities and towns in southeast China, is featured by the prosperity of SMEs(small- and medium-sized enterprises)-driven economy. SMEs have their advantage of flexibility, rich heritage from traditional industry, capacity to provide large amount of jobs for local labor force, which is especially important during rapid urbanization, and comparatively low risk of new technology implementation. That's why they are widely spread and in rapid growth. While on the

other hand, SMEs have their limitations, such as low level of management, improper organizational structure, insufficient funds and technology in production, quality control and pollutant/waste treatment. According to a conservative estimation, township- and village- enterprise, which are among the SMEs, discharge more than half of all industrial wastewater in China. And since they are widely scattered across vast areas, their environmental impacts could be difficult to control. Thus, how to let SMEs exert their advantages in local economic development and improving their shortcomings is a key factor in the effort of achieving sustainability in the small cities in China and other developing countries.

3.3 Social Considerations of Urban Sustainability

Increase the level of awareness about urban sustainability is also an important issue for either the improvement of social equity and sustainable development itself. Usually in big cities, the situation is a bit better. While in small towns, since the industry scale is comparatively small, the competitions are not as drastic, and a large proportion of the population are directly transferred from rural area so that inevitably having lower education level, much greater effort need to be made to promote the comprehensive understanding of urban sustainability among all the residents through communication and education in order to direct the living and production mode in those small cities and towns towards sustainability.

On the technical level, proper urban planning strategies, including land-use planning and sustainable urban design, will contribute to a sustainable urban layout, and a sustainable operation of the cities, which will ultimately contribute to social equity.

4. Conclusions

Based on our analysis, we have to admit that there's still a long way to go to achieve urban sustainability in small cities and towns in China given the current processes of urbanization and industrialization. Technical means to control certain forms of pollution might be easy to figure out and to implement, however, the more important is a comprehensive and in-depth understanding of the whole picture and to act on the strategic level. The following are the key issues we'd like to emphasize for achieving urban sustainability in the large numbers of fast developing small cities and towns in China, as well as in other developing countries.

4.1 Establish proper attitude to the relationship between development and environmental protection

When looking at the environmental problems, especially those caused by high-speed development, it's necessary to first of all justify the relationship between development and environmental protection. The consideration should be based on a long term point of view and must be dynamic. These two are not necessarily conflicting. Promoting urbanization and industrialization level is already been proved as a "must and inevitable" in China, so the proper attitude is to observe the processes, find their environmental impact and work out systematic countermeasures accordingly with vision and wisdom, aiming at achieving sustainability without sacrificing the opportunities to develop. Actually, to settle environmental problems rationally as well as effectively will not only promote the environmental quality and life conditions for people, but also give the development of regional economy more freedom. It could truly be a win-win situation.

4.2 Consider local problems in a global context

The environmental problems the large number of Chinese small towns are now having is not only influencing themselves, but surely has regional effect and even global. The water contamination and air pollution in this area will have effect on the global climate change, marine pollution, trans-border pollution, and even the biodiversity loss. So to address these problems correctly has significance to the global environment.

4.3 Recognize the important role of SMEs

There is a growing recognition of the role that SMEs play in sustained global and regional economic recovery (Ayyagari et al. 2003). The unique role of SMEs in the economic development of Chinese small cities and towns and the accompanying environmental impact have been discussed in detail in section 3.2. Here we want to emphasize that, the proper development of SMEs is an important step, and a promising as well as realistic opportunity for those small cities and towns to achieve sustainable development pursuing high productivity level and more satisfactory living condition for its people at the same time.

4.4 Promote the awareness of sustainable technology, including sustainable urban design and "green" building technology

In the case study of the economic development and environmental problems in Keqiao, it has been clearly recognized that proper technology could make a lot difference. These technologies could be technology in resource and energy utilization that can drastically increase the efficiency and reduce the production of pollutants. They could be proper treatment technologies for the sewage or solid waste before discharged into the environment that can minimize the negative aspect of development. They could also be technologies of utilizing renewable energy and technologies of recycling.

I would also like to emphasis the proper urban planning, urban design and building technologies that can have a big impact on the urban land-use layout, urban transportation system, and even the way of living for urban residents, which will finally contribute to the pattern change of energy consumption.

4.5 Get the most out of international cooperation and benchmarking

Finally, though the local and the state governments' responsibility should be emphasized on solving environmental problems accompanying economic development, besides the commitment of local government and the effective environmental law and policy established by the central government, international communication and cooperation are also powerful tools for working out proper solutions either for certain environmental problems or for the overall sustainable development strategies. By intensive cooperation and benchmarking, the local government of Chinese cities will be able to consciously seek for best practice in developed countries or other developing countries, in order to learn from them and avoid repeating their mistakes. Based on the understanding of their specific situation, seeking for exterior support and advices is for sure a wise strategy for Chinese small cities and towns to change their traditional development mode that was featured by large consumption of resources and extensive management, and to approach the status of urban sustainability.

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