CHINESE ECO-CITIES, AN INTEGRATED SECTORAL APPROACH OR AN ECO^{2}CITIES APPROACH?

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Summary: Cities, aware of their environmental challenges, have introduced policies and programs to deal with issues like climate change and pollution. They want to become more ecological which would secure them the label of 'eco-city'. Policies found in such cases are: closing the water cycle to lose no water; stimulating energy savings and reducing the greenhouse gas emissions; reducing waste and putting in place integrated waste management; developing integrated transport policies, etc. It is a challenge to achieve these goals with stakeholders in the framework of urban management, defined as implementing urban plans. Efforts to create eco-cities in China will be analyzed in this paper to determine to what extent they have contributed to the development of livable, productive and inclusive cities. What were the key urban policies that contributed to their success and which lessons can be drawn from successful examples of eco-cities or neighborhoods that can inform rapidly urbanizing cities in developing countries on how to achieve sustainability? Evidence collected from eight Chinese eco-cities using different indicators is used to determine to what extent these cities are examples of a sectoral or an eco^{2}cities approach.[1] The analysis shows that the approach of Chinese cities is often not based on a strategic vision at the city level but involves activities at the neighborhood, building or household level. In practice the focus of aspiring eco-cities is often on one or two sectoral issues instead, such as energy saving, dealing differently with the water cycle, or pollution abatement.

Key words: Eco-city, ecological policies, water issues, energy saving, transportation policies, urban management

[1] The Eco^{2}Cities initiative launched by the World Bank intends to help cities in developing countries to achieve greater ecological and economic sustainability, based on a strategy or plan.

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I. INTRODUCTION: WHAT ARE ECO-CITIES?

Globally cities face environmental challenges and have to introduce policies and programs to deal with issues like climate change. Often they want to become more ecological cities, commonly termed eco-cities.[i] In this contribution we will look at the major policies which make cities more eco friendly and will compare the eco^{2}cities approach with a more sectoral approach with stakeholders playing a role at different levels, such as the city, the neighborhood, the building and the household level.

Planning for the future of the city is a visionary debate and decision process, not a straight forward computer-driven process. What exactly are eco dimensions of eco cities? One can find very idealistic, very sectoral, or issue based definitions of ecological cities in addition to more strategic and integrative approaches. Norms and values play a role for example when a distributional issue comes up like: should poorer people also enjoy more green environments? And should investments be made in lowering their energy consumption, or should the emphasis be on their economic development?

Many cities claim to be ecological cities, but given that there is no generally accepted definition of ecological cities these claims are difficult to sustain. Many definitions have been suggested for eco-cities (for example in Bhatnaghar ed., 2009) and some authors have put their own subjective view on what is important in these definitions. Kenworthy (2006: 70) emphasizes the role of transport, Rombout (2009) stresses the importance of greening cities (he talks about garden or lobe cities) and Raj (2009) stresses an environment culture parity in urban development planning.

Wong and Yuen (eds, 2011: 3) note that the eco-city concept "suggests an ecological approach to urban design[ii], management and towards a new lifestyle". The eco-cities movement advocates sustainable urban development, or cities which function in harmony with their natural environment. Ten dimensions for sustainable city development in the Third World have been suggested by Kenworthy (2006: 68). His dimensions for sustainable city development in the Third World give a good understanding of the issues at stake. In his terms, a sustainable city is characterized by a "compact, mixed urban form that protects the natural environment, biodiversity and food-producing areas, ... the natural environment permeates the city's spaces and embraces the city, while the city and its hinterland provide a major proportion of its food needs".

We suggest considering five main policy dimensions for moving towards a more ecological city. The approach can be contrasted with the Eco^{2}cities approach of Suzuki et al. (2010). Their idea is to overcome the assumed contradiction between economic and ecological development. Moffatt et al. (2012) provide an overview of the Eco^{2}cities approach. The main idea is that cities

should be ecological cities as well as economic cities (Suzuki et al., 2010). The approach is based on four principles:

1. A city based approach
2. An expanded platform for collaborative design and decision making
3. A one-system approach
4. An investment framework that values sustainability and resilience

The publications of the Eco^{2}cities initiative give a number of examples of cities which have succeeded in integrating the economic and ecological development.[iii] Subsequently a number of methods and tools have been developed for eco^{2}cities. Methods to help with the process of decision making and to enhance group engagement and tools such as templates, checklists, diagrams, maps, specialized software applications and workshops, which are available for users.

The approach can be criticized by pointing to a lack of specificity to what an economic city or an ecological city would look like, but its beauty is the effort to try to combine two often divergent approaches in urban management. From the synopsis of the Eco^{2}cities initiative we can learn that the approach is different from the conventional approach to urban management by:

1. The emphasis put on a strategic approach to eco^{2}city development
2. The use of a number of principles, which can be assessed for each city and of which the score can be put into a spider diagram
3. The distinction of three core elements of Eco^2 development: leadership, planning and a supportive environment
4. Providing a number of methods and tools
5. Emphasizing the importance of mobilizing the necessary finance
6. Its bottom up approach
7. The emphasis on innovations
8. An integrative or systems approach
9. The emphasis on equity
10. The use of performance indicators

II. MAJOR DIMENSIONS OF ECO-CITY POLICIES

In the literature about eco-cities four issues can be distinguished:

1. Eco-cities are conceptualized as ecosystems where there is an interest in circularity of physical processes of resources (Wong and Yuen eds, 2011: 3)[iv]
2. These cities need to deal with challenges resulting from rapid urbanization, industrialization and climate change in the framework of urban management (Van Dijk, 2006: 50)
3. Different dimensions of an eco city are mentioned as being important (Kenworthy, 2006: 68)
4. The need to deal with the challenges through an holistic approach which takes the interrelations between the different dimensions into consideration during the implementation (Van Dijk, 2011: 33)

We will discuss some examples of eco-cities. The following five main issues will come back in these cases: the importance of ecological thinking (in terms of reducing pollution or promoting eco-infrastructures; Betancourth, 2011); closing the water cycle and going for waste minimization and integrated waste management (Ministry of Information Singapore, 2008); stimulating energy savings and reducing the greenhouse gas emissions (Glaeser and Kahn, 2010); developing integrated transport policies (Kenworthy, 2006: 67) and involving the different stakeholders during the implementation. Hence the five main dimensions of an eco-city policy which will be reviewed in this paper are:

1. The ecological dimension
2. Water and waste
3. Energy saving
4. The role of infrastructure and transportation
5. The role of urban management to involve the stakeholders during the implementation of eco city ideas

III. THE METHODOLOGY

Ecological activities in a city can take place at different levels. Four levels will be distinguished: the city, the neighborhood, the building and the household level. Burnett (2007) points to the possibility of providing eco-labels to a city to prove its eco character. Secondly the focus could be on a neighborhood, or a new town. Then we will also give examples of ecological buildings: ecological villas, blocks of houses, or apartment buildings with common heating/cooling systems or shared grey water re-use facilities. Finally individual initiatives can be noted at the household level, installing for example sun boilers, spontaneously or triggered by incentives.

This paper is based on a number of case studies of Chinese cities that were identified using the following criteria:

a. Presented by the authorities or in articles as an example of an eco city
b. The ideas to make it an eco-city are actually implemented
c. Possibility of a visit to collect information on the different activities on the five dimensions and four levels distinguished
d. Possibility to collect data on indicators for the different dimensions and levels

The ambition of this study is to determine to what extent these cities are examples of a sectorally implemented or of an integrated eco^{2}cities approach, which introduced a package of activities to the city to make it economically sound and ecologically sustainable. The main difference between the integrated eco^{2}cities approach and the sectoral approach is that integrated eco^{2}cities approach emphasizes integration in the framework of a strategy, while the sectoral approach presented in this paper, stresses the relations during implementation with stakeholders between different policy dimensions, such as the greening of the cities (the ecological dimension), dealing differently with water and waste, diminishing the use of energy in general and electricity in particular, the role of infrastructure and transportation and an urban management approach, defined as implementing an urban plan together with stakeholders (Van Dijk, 2006: 7). Although

eco-cites require a comprehensive or integrated approach, based on the data for the eight Chinese eco-cities used as case studies in this report, we will show that initiatives are often very sectoral and not at all based on an integrated strategy.

The reason to pay attention to different sectoral dimensions of eco-policies is that often the specialists and implementing agencies are organized by sector and integration among the sectors in the implementation stage is a real problem. Energy experts know very little about water and transport professionals may not think in ecological terms. Housing policies for example are also important because they do not just concern the numbers of units built. These policies also have to do with the choice of a location (what it means for transport), the quality of the house (is it for example isolated?) and the implications for CO_2 emissions during the construction process. While all of these issues are important, this paper will not be able to deal with all aspects of eco-cities. The issues specifically dealt with will be the ecological dimension, water and waste related aspects, energy aspects, the role of infrastructure and transportation and the management of becoming an eco-city.

IV. THE ECOLOGICAL DIMENSION

Different authors emphasize the importance of a green city, or nature conservation (Betancourth, 2011).[v] Trees have been part and parcel of cities and deserve a place, even if they may hinder the circulation of vehicles. Open and green spaces in an eco-city can serve several functions. For that reason, Duc Uy and Nakagoshi (2007) introduce land suitability analysis to optimize the benefits of urban green spaces. The percentage of green space to total space would give an indication of the success of these policies.

How does the city deal with different pollution issues? Eco-cities should thrive to have low pollution rates. Therefore policies to deal with different pollution issues are very important. Indicators can be chosen to measure different types of pollution or the city's footprint and the resulting score would quantify the quality of urban life and the reduction of the city's foot print (Van Dijk and Zhang, 2005).

Eco-cities are often presented as a new green paradise, where it is good to stay and where the negative environmental impact of living and working is reduced. Cities may make an effort to emphasize their ecological nature. Under this dimension, we will consider efforts to create a greener city through conservation and pollution abatement, as well as dealing with the consequences of climate change.

How does an eco-city deal with climate change issues? Different climate change scenarios combined with increased pollution reveal the threat of temperature increases, more rain or bigger droughts for cities. Climate change forces cities to opt for mitigation activities, or for climate adaptation policies. Cities aware of their environmental challenges have introduced policies and programs to deal with these issues. Research points to the importance of policies for climate mitigation and adaptation and of leadership at local government level to deal with the issue (Howe et al. eds, 2012).

V. WATER AND WASTE RELATED ASPECTS

Due to climate change, cities may face floods or water shortages. They may have problems with drinking water, waste water and/or solid waste treatment. Under this dimension we consider different, more ecological ways of dealing with water and waste.

Relevant questions are how can the projected changes in water supply result in the adaptation of adequate policies in the concerned cities? The Millennium Development Goals (MDGs) attempt to address water and waste issues in the development countries by trying to halve the number of people with no access to safe water by 2015 in addition to halving the number of people without access to safe sanitary facilities. The first goal may concern about one billion people, but there are almost two billion people in the world with no access to safe sanitation. Dealing with this issue in a Third world urban context is a real challenge. We want to point to efforts to deal with waste water differently, to promote eco-sanitation and the use of collective toilet facilities. Solid waste is an important issue in cities and dealing with waste in a different way is required, for example because waste can also block drains and cause health hazards (Usunju et al., 2011). Solid waste minimization and integrated waste management are important.

What do changes in available rain water mean for drinking water supply and sanitation? Solutions considered for the challenges caused by changes in available rain water focus on integrated water resources management, which means closing the water cycle (not to lose any water) as argued by the Switch project (Howe et al. eds, 2012). Policies suggested besides closing the water cycle are promoting rainwater harvesting (Liang and Van Dijk, 2011). The Switch project also looked at different ways of urban water management and the efforts made to separate grey and brown water (Liang and Van Dijk, 2010). The Switch project showed there is an extensive use of environmental technologies for water and waste management, contributing to making the city's life support systems become closed loop systems, where no resources get lost. Criteria to assess the progress in this case would be yes or no closing the water cycle and what has been achieved in terms of waste reduction and recycling?

VI. THE ENERGY DIMENSION

Energy management would also be part of a more ecological city. It usually means reducing greenhouse gas emissions. Indeed, increased energy use and the resulting CO_2 emissions are an important reason for climate change, which has an indirect negative effect on cities. Very often the emphasis is on CO_2 reduction. Kennedy and Sgourdis (2011) emphasize rightly the need to come up with a rigorous classification of different emissions and an agreement on carbon accounting principles (which sectors produce how much emission of what in a direct or indirect way) to achieve the ideal of a low or zero carbon city. Smith Morris (2011) shows how in the 'New urbanism' in England CO_2 reduction played an important role. Different projects wanted zero carbon buildings and the eco-towns concept only later broadened its meaning. There is an extensive use of environmental technologies for energy management to make the city's life support systems become closed loop systems.

How do we measure how the city deals with energy issues? Different indicators have been suggested. Glaeser and Kahn (2010) focus on the actual CO_2 emissions in urban areas and the possibility to reduce them, but we should also look at energy saving at the household level, at

efforts to reduce green house gas and to introduce renewable sources of energy. Measurement would also require the use of other indicators, such as the use of solar energy (for example solar panels), the use of wind energy (of which the production should ideally be allowed to be ploughed back in the network) and a registration of the use of heating and cooling systems, using underground or river water. For short the question is what does a city have to achieve in terms of energy reduction to be called an eco-city?

VII. THE ROLE OF INFRASTRUCTURE AND TRANSPORTATION

A city requires goods and people to move around using infrastructure and different modes of transportation. However, there are many infrastructural options and different modes of transportation and some are more environmentally friendly than others. The choice between these different modes is often conditioned by history, culture and climate and in some countries bicycles have survived because a proper infrastructure was provided (separate bicycle lanes), or the current regulation protects cyclists (in the Netherlands).

Most of Kenworthy's (2006: 68) list of dimensions for sustainable city development in the Third world deal with infrastructure and transportation. He emphasizes the need to move away from a car dominated city and to build cities around foot paths, bicycle lanes and public transportation. In an eco city: "a freeway and road infrastructure is deemphasized in favor of transit, walking and cycling infrastructure, with a special emphasis on rail. Car and motorcycle use are minimized. ... The central city and sub-centers within the city are human centers that emphasize access and circulation by modes of transport other than the automobile, and absorb a high proportion of employment and residential growth. ... The city has a high quality public culture, community, equity and good governance. The public realm includes the entire transit system and all the environments associated with it".

Transport is an important issue, since it is crosscutting: it has to do with different means of transportation and their fuel consumption and with the design of a city. Transport can be an important source of air pollution and causes a lot of noise. Finally, transportation is an important issue in physical planning, which can also help to deal with the issue. Indicators chosen are the use of bicycles and cars in the city and the efforts made to come to an integrated transport policy. Integrated transport policies are desired, but often specialized departments and different levels of government deal with different modes of transportation and different types of roads. What has been achieved in terms of reducing travel time and congestion? Has a rapid transit system been introduced, or an alternative type of transportation been promoted in our eco-city?

VIII. THE MANAGEMENT OF ECO CITIES

Several chapters in Wong and Yuen (eds, 2011) emphasize the importance of planning of eco-cities. Within urban development a distinction can be made between the urban planning and the urban management approach. In the first case the design, the planning process and the resulting urban plan receives most of the attention. The urban management approach emphasizes the importance of putting a plan into practice, with the help of all the relevant stakeholders. The urban manager may take a more activist stand, trying to achieve the necessary investments by promoting participation of all stakeholders (Van Dijk, 2006: 26).

Planners are concerned with the provision of housing, infrastructure and public transport and financial constraints may prevent them from considering green options. Eventually the private investors and project developers have a large say in the implementation stage. Some of them are interested in green features because it may increase the value of their property. Planning eco-cities has its own challenges. How can the eco-city be sustainable in the long term, when the issues change and alternative technologies may become available? To manage this process the involvement of stakeholders in the implementation process is crucial.

IX. SOME RECENT CHINESE EXAMPLES

Most examples of eco-cities in the literature are located in Europe or the Americas, but China probably has the largest number of new initiatives for eco-towns. Wu (2012: 170) notes that more than 100 Chinese municipal governments are proposing to build eco-cities or eco-towns. These are often new towns and low carbon cities and often international partners are used to achieve the desired status. To what extent do these examples contribute to the development of livable, productive and inclusive cities? What were the key urban policies that contributed to their success and which lessons can be drawn from successful examples of eco cities or neighborhoods that can inform rapidly urbanizing cities in developing countries how to achieve sustainability?[vi] Dongtan (near Shanghai) is often mentioned as a real different approach to eco-city development, although it is now a failed project (Van Dijk, 2011). Recently an ecological harbor was announced in Shenzhen (China Daily, 8-5-2012). We will also present briefly initiatives in Dalian and Tianjin, having presented Beijing, Dongtan, Shenzhen and Wuhan in more detail in Van Dijk (2011).

The initiative to develop an ecological harbor in Shenzhen is unique. It uses inputs from the state-owned Overseas Chinese Town Group (OCT) and the port has been designed as part of overall urban development, rather than as a tourism destination outside the city. The boulevards, plazas and beach at OCT Harbor are already a popular destination for people from Shenzhen. The emphasis is on the way polluted water is treated and the natural environment is restored. It is also hoped to save energy and to reduce emissions. The initiative taken by the state-owned Overseas Chinese Town Group wants to provide a new model for how China can transform cities.

Dalian in China aspires to be an environmentally friendly city and Yong et al. (2009) evaluate the results in terms of water use, energy use, waste generation per capita and its reclamation and treatment. It is mentioned that this wave of initiatives is linked to a certain degree of economic decentralization and the rise of the entrepreneurial city. However, the initiatives are also part of international pressure on China and a movement within China to reduce its greenhouse gas emissions. China has formulated specific objectives in its 11th plan (2005-2010) concerning per unit GDP energy consumption and wants to reduce its carbon intensity by 40 to 45% between 2005 and 2020. The interesting aspect of these projects is that they are not state-funded, but built with real estate developers.

Achieving the designation eco-city from the central government in China signifies the approval of flagship development. A flagship eco-city project close is located 45 km from the city of Tianjin and is developed in cooperation with Singapore and partially financed under the Global

Environmental Facility (GEF). Dunn and Jamieson (2011) evaluate it in terms of the relation between eco-city development and sustainable tourism. The objective of the project is to develop an economically sustainable, socially harmonious, environmentally friendly and resource conserving city. Fulong Wu (2012) notes that it is located in a newly established district, which is a national strategic location comparable to Pudong in the 1990s. Total investment is expected to reach 30 billion Yuan, while China and Singapore each control half of this investment. It is largely located on unusable land, which makes the investment less sensitive to outside critique.

Table 1 Main emphasis in 8 eco-city initiatives

Dimensions	Beijing	Dalian	Dongtan Shanghai	Nan Jing 2008	Shenzhen city	Shenzhen port	Tianjin	Wuhan
Level a. City (C) b. Neigh (N) c. Building (B) d. Household (H)	C	C	N	C	C	N	N	B
Eco & pollution (P)		P			E	P	E	
Water & waste (WW)	Wat	Ww				Wat		Wat
Energy aspects (E)	E	E				E		E
Infrastructure/transportation	I&T							
Integrated/sectoral	N	Y	Y	Y	N	Y	Y	N

From the table we see that although the challenge is to achieve integration in framework of an urban strategy and plan, in many cities the initiatives are mainly sectoral (focusing on energy saving, water related issues, pollution abatement or ecological features) and sometimes only on one or two levels below the city level.

X. CONCLUSIONS

Eco cities can be seen as a new life style and type of management, which is more in harmony with the natural environment and predicated on the objective of long term sustainability. The focus is on the urban metabolism or a different way of dealing with the cycles of energy, water, waste and pollution. Some authors want to go further by emphasizing the different life styles and the importance of community values. A real challenge is to keep up and expand the existing eco initiatives in a rapidly changing world where other priorities may develop.

Efforts to create urban environmental sustainability in a number of Chinese cities were analyzed and the question was to what extent have these cities followed a strategic city based or a more sectoral approach? Table 1 showed that almost half of the examples followed a more sectoral approach and in only half of the cases the emphasis is on the city level. The advantage of separating different sectoral interventions is that it allows a comparison or benchmarking on these dimensions, taking different indicators and comparing the performance. The initiatives do

not have to come from governments, project developers and private individuals can also take the initiative and the activities of these stakeholders should be incentivized.

Ideally the city would follow a system approach to assess the interaction between the different components distinguished so far. Objectives concerning justice such as equality are important, while also managing the urban risks. All decision making should be sustainability-based, integrating social, economic, environmental and cultural considerations as well as compact, transit-oriented urban form principles. Such decision making processes would be democratic, inclusive, empowering and engendering hope. The evidence collected for these eco-cities using different indicators shows that their approach is often not integrated nor based on a strategic vision document. Integration could take place in the framework of urban management, but the emphasis should be on involving stakeholders in implementing sectoral initiatives, facilitating their initiatives at the city, neighborhood, building and household level.

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Notes

[i] There is an eco-city movement, if measured in number of conferences, articles and books on this topic.

[ii] Sustainable development is defined as development that meets the needs of the present generation without compromising the needs of future generations (Brundland, 1987).

[iii] Curitiba in Brazil and Stockholm, capital of Sweden, pop up regularly, but also examples from lesser known cities like Yokohama and Soweto are presented.

[iv] Yong et al. (2009) show how the circular economy concept is introduced and implemented at the regional level when evaluating the progress in Dalian with implementing China's circular economy concept at the regional level.

[v] Betancourth (2011) makes the case for eco-infrastructure based on a case study in Colombia (Cartagenena).

[vi] Evidence collected in the framework of the SWITCH project (Sustainable Water Improves Tomorrow's Cities' Health) has been used concerning Asian cities (Howe et al. eds, 2012).