

A Study on the Management and Planning of Ecological City in Erlangen and Implications for the Ecological City Planning and Management in China

Liya Zhou*

The First Affiliated Hospital of Wenzhou Medical University, Wenzhou, Zhejiang, 325000, China

zhouliya@wmu.edu.cn

**Corresponding author*

Keywords: Erlangen, Eco-city, Urban Planning and Management, Strategies

Abstract: Erlangen was once a US military base in Germany, but had been transformed into a world-renowned ecological city through scientific eco-city planning and urban management. This thesis introduces the history and current situation of the city, analyses the existing problems, and compares the urban planning concepts of Germany and China. It concludes that eco-city development is an inevitable choice for urban areas. Secondly, the paper focuses on the three strategies that were implemented in Erlangen: rational land use planning, promotion of low-carbon green transport, and ecological recycling. Thirdly, it analyses the successful experience and challenges faced by Erlangen, and presents critical thinking. Finally, this paper analyses the impact of the successful experience of Erlangen on the planning and management of ecological cities in China. It covers topics such as sustainable land use patterns, the development of a sustainable economy, public transport, innovation in planning procedures, and public participation. The paper concludes by offering practical suggestions for the future construction, planning, and management of ecological cities in China.

1. Introduction

1.1 Origins and Evolution of Ecological City Planning

In 1971, UNESCO launched 'Man and the Biosphere Program' (MAB) and proposed a concept of 'urban ecology', including urban ecology, climate, human activities, such as housing and succession issues, opened up eco-city research and development [1].

The term 'eco-city' is widely traced to Richard Register's (1987) book, *Eco-city Berkeley: Building cities for a healthy future*.

Register's vision of the eco-city is a proposal for building the city like a living system with a land use pattern that supports the healthy anatomy of the whole city, enhances biodiversity, and makes the city's functions resonate with the patterns of evolution and sustainability [2].

Since then, several similar themes such as 'eco-neighborhoods', 'urban eco-village' and 'eco-communities' have emerged, all emphasizing ways of making the city more

environment-friendly and sustainable [3].

A review of the work of nineteenth century planning pioneers would indicate views of landscape as a living entity and their concern for preservation of nature beauty and ecological function with planning tasks.

Into the twentieth century, these early ideas were expanded on by Lewis Mumford and Clarence Stein, leading to the development of several greenbelt towns in USA.

Mumford (1961, 2004) identified the un-sustainability of urban development trends in the twentieth century, arguing for “the development of a more organic world picture, which shall do justice to all the dimensions of living organisms and human personalities” [4].

Others such as Ian McHarg (1969) have developed the concept of ecological planning, proposing the theory and methodology of ecological land use planning that explicitly connected ecology theory to planning and design practice and laid a new integration of human and natural environments [5].

1.2 Eco-City Planning: Inevitable Choice

Why eco-city?

- Resources limited
- Environment polluted
- Urban heat island exacerbated
- Water and energy shortage

As is shown in Table 1, in China, the eco-city refers to the city which regards ecological as an urban character, urban targets, city characteristics, in order to promote the city's overall socio-economic environment in harmony with the scientific development [6].

Table 1: Content comparison between Chinese urban planning and eco-city planning

Urban planning		Eco-city planning
Urban system		Ecological urban system Ecological functional area planning...
Urban land use	Scale Forecast	Ecological capacity control
	Spatial layout Partition function	Ecological structure planning Ecological Park
	Character of land use	Mixed land use Old urban regeneration
	Distribution of resident population	Ecological community planning
	Public service facilities	Public Space Public facilities
	Green system	Ecological Landscape Planning
	Development intensity	Development intensity control

Infrastructure	Transportation	Public transport system Slow System Planning Accessibility improvement...
	Municipal facilities	Renewable Energy usage Rain and sewage diversion...
Protection of nature and history	Nature Protection	Natural Protected Areas Biodiversity Conservation...
	Historical and cultural protection	Protection of historic buildings and areas
Environmental Health Urban Disaster Prevention	Environmental Health	Recycling of resources Resource recycling industry planning...
	Urban Disaster Prevention	Disaster Facility system Planning
Architecture and Urban Design	Building Type Building volume City color...	Green Ecological Technology Site and architectural features mixed

Ecological and sustainable city development theory was put forward step by step which witnessed the human city development in different historical periods and the main problems faced by people looking for appropriate countermeasures.

2. Case study of Eco-city: Erlangen, Germany

2.1 Background

1) Focus on the History of Erlangen

Erlangen is a Middle Franconian city in Bavaria, Germany, from München 200km. It is a part of Nurnberg which contains Nurnberg, Erlangen, Fuerth and Schwabach. It is as a famous 'university town', 'Simons Town' and 'a eco-city'. Erlangen is also as a modern scientific research and industrial center which has more than 100,000 inhabitants and the area is 77 km² as is shown in Figure1.



Figure 1: Map of Erlangen

Erlangen has a long and colorful history, and today what we know just only a part of it. The critical thing is the ability of this city's self-creation which generates the development of Erlangen and also that the eco-city strategies we applaud [7].

2) 'A new home' given by the Margrave

Erlangen was like the late medieval and early modern city which had experienced many wars and disasters. So after the Thirty Years' War, Erlangen was virtually uninhabited [8].

This only changed in 1685, when King Louis XIV revoked the Edict of Nantes which had granted freedom of religion to the Calvinist Huguenots. That caused a wave of Huguenot refugees which Margrave Christian Ernst turned to his advantage. He granted the Huguenots leave to stay in Erlangen in the hope of boosting the local economy [9].

It quickly became clear that the town was too small for all of them and that a new settlement was required. The location chosen was an area to the south of the original town. Designed by Johann Moritz Richter, it then became the ideal baroque town.

3) 'An opportunity'

When a fire destroyed almost the entire original town in 1706, this presented the perfect opportunity to extend the baroque designs of the 'new town' to the rest of Erlangen, creating an early masterpiece of integrated urban planning.

4) 'A gift' given by reconstruction after World War II

According to the European standards, the development was pretty fast: in the 1870s, from 1945 to 1972, employment opportunities grow exponentially, creating 50,000 jobs. In addition, population grew up to 100,000. All these things were treated as a beneficial power to the development of the city and also every citizen were so proud of the rapid rise of Erlangen.

5) Urban issues are gradually emerged:

Discomfort and criticism was growing with the rapid economy increasing: mainly for negative effects, such as the considerable number of urban green space, forests and countryside of idle land to lose, especially the automotive growth leading to a growing amount of noise, air pollution and streets crowded [10].

3. Strategies for Erlangen Eco-City Planning

3.1 Land Use Adjustment

1) Land use plan with an integrated landscape plan in Erlangen .

In terms of sustainable development, this was the hitherto independent plan works with zoning and landscape plan being merged into a complex unit. An important basis for planning was the Environmental Impact Assessment (EIA).

2) 16th Change in the land use plan with an integrated landscape plan for 2003

The Land Use Plan amendment area was located in the district south of the wine road, west of the outskirts of the village buildings, north of Hutgrabens and east of the motorway. Another goal of change was to be able to meet in close proximity to the established high demand for new commercial space in Tennenlohe as is shown in Figure 2.

3) 18th Change in the land use plan with an integrated landscape plan for 2003

The land use plan with an integrated landscape plan for 2003 was to be amended to enable the development of commercial construction areas west of the existing commercial area Geisberg. Thus, the urgent demand was taken into account by commercial areas in the city as is shown in Figure 3.

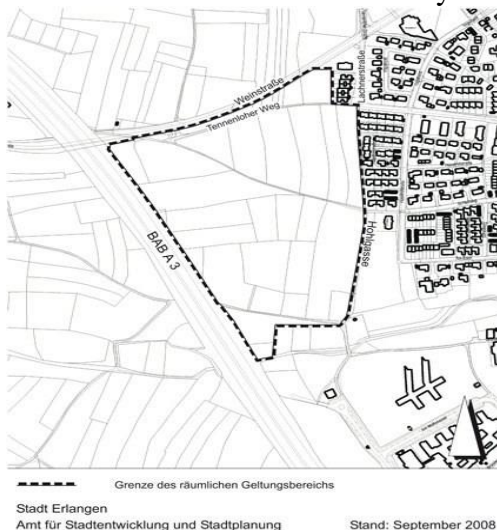


Figure 2: 16th Change in the land use plan

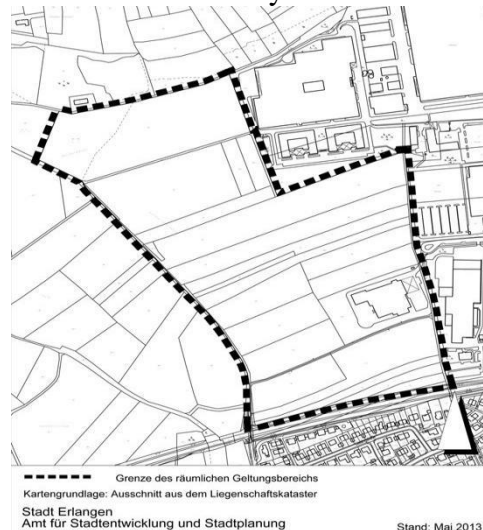


Figure 3: 18th Change in the land use plan

4) Land Recycling—'The brownfield' in Erlangen

The brownfield redevelopment would provide housing and natural environment without new land use, and this was defined as use-related reintegration of land in the economic and natural cycles.

3.2 Creative Housing and Living Environment

1) Growth and control of living space

From 1973 to 2001, the average living area per person increased from 26m² to 40 m². But the real situation was that the city population keeps 100,000 and the population in surrounding places had grown up to 4 million. Because all this did not happen, Erlangen was still a green city which was surrounded by many big forests and farms.

2) Living environment and open space--Central Green Corridor

The living environment was close proximity to a residential area. A quality feature was the provision of open space, community facilities, green areas, etc. within a reasonable distance.

Central Green Corridor: a varied and diverse range of open public space:

The design of the central green corridor was developed and was realized. The central green corridor extended from north to south through, where the majority of buildings border on the green corridor linking the district centre with a nature reserve, thus the government could plan green space as a future city park as is shown in Figure 4.



Figure 4: Central Green Corridor

The green axis extended to the south and geographic area effectively so that integrate habitat protection zone into the landscape. The green axis enables the affiliated residential districts in east and west to participate in their "green edge" directly from the free-space, utilization and relaxation as is shown in Figure 5.



Figure 5: The green axis

3.3 Transportation and Sustainable Mobility

1) New transportation policy

It made equal enjoyment of various forms of transport in urban traffic convenience, such as walking, cycling, car and use public transport. In Erlangen, because of the higher standard of living

so that power level was very high, 10 million people have 54,000 cars. However, they also had 80,000 bikes and regular use. Bicycle usage of residences in Erlangen was 30%.

2) Successful pro-bicycle policy

From 1977, the cycling network planning outline called drivers to choose public transport and softer means of transport above their cars. Developing environmentally-friendly means of transport is at the heart of Erlangen's transport policy.

(1) Equivalent transportation plan and equivalent means

The plan was to meet the mobility needs of society without compromising other basic needs. Therefore the conscious and sustainable use of resources and mobility is paramount.

The way to the car should be as far as the bus stop or trip to the bike paths by bicycle and on foot achievable goals are so obvious and easily accessible.

(2) Build the cycle infrastructures and design the user-friendly cycle tracks

Innovative corridors including bikeways on sidewalks, one-way streets, and mixed streets dedicated to bicyclists were built. They were painted red, which not only facilitates crossing intersections but also commands vehicles' and pedestrians' respect.

(3) Update the hard and soft infrastructures

Use signposts and road for cycling, improve parking conditions, detailed cyclists' map.

3.4 Ecocycle Balancing

1) Garbage collection, classification and cycling

Household waste management in Erlangen has achieved great success. Initially many experts think that this project may be completely impossible. But after this system was implemented in the whole city, there was no need for a new, expensive and controversial incinerator then. Garbage collection containers can be found very easily near their homes in Erlangen. If they need to dispose something heavy and poisonous, they can make telephone calls or search the website. A truck will come and receive the waste.

2) Composting factory of Erlangen

Erlangen provides a composting factory which can produce garden compost. For this purpose, in 2006 a total of 6,800 tons of green waste were processed. The Erlanger waste bins in 2006 contained 11,000 tons. For delivering garden waste, citizens then had a corresponding reward and also high quality products are produced from the city.

3) Wastewater treatment

In Erlangen, rivers became cleaner. Because in the past 20 years, the city sewer system in the city and around the city had been completed (even cover the entire country), and a stable modern sewage treatment factory had been built as is shown in Figure 6.



Figure 6: The sewage treatment factory of Erlangen

3.5 Building Ecologically

1) Green buildings with DGNB certificates

According to German Sustainable Building Council, in Erlangen, two buildings were assessed and certificated by DGNB because of their outstanding commitment to meeting sustainability objectives. The government buildings played a pioneering role in buildings sustainable buildings.

2) Solar buildings in Erlangen and the projects are shown in Table 2

Table 2: Projects of Erlangen City Hall

Project name	Erlangen City Hall
Usage profile	New office & Administrative buildings
Building Evaluation	72.30%
Feature	Solarwall air heating system

3.6 Innovations and Inspirations in Sustainable Economy

1) Goals Erlangen will follow

Strengths in the medical sector should grow further and cumulate in being the ‘German capital of medical research, production and services’. In the longer term they had set further ambitious objectives: As ‘E city’.

In a further step Erlangen as ‘knowledge city’ will decisively contribute to finding innovative new forms of acquiring and processing knowledge on the way to the information society.

2) Innovations and Inspirations for economy: Health the main thing – Federal capital of medicine

Medicine has a tradition in Erlangen. In the city itself it has been within reach for a long time. Medical research, practice and teaching, biotechnology and medical engineering production determine the daily working routine of every fourth employee in the heart of the regional “Medical Valley”. And thus it is the life of an entire city.

3) Focus on high-tech

In first place is Siemens with five corporate groups based on the Erlangen headquarters. In addition numerous predominantly medium-sized and highly specialized companies will develop solutions that frequently attract attention on the world market. Therefore Erlangen faces economic structural change with more composure than other industrial sites that have traditionally depended on only a few large companies. The high-tech location of Erlangen created a sensation world-wide above all by the development of the MP3 standard for audio coding.

4) Use knowledge as a support

The Friedrich-Alexander University of Erlangen-Nuremberg has been for more than 250 years, those who study also practice open-mindedness – towards new ideas, foreign perspectives and unknown worlds. In Erlangen studies are not pursued on a campus remote from everyday life, but integrated into the heart of modern city life. The research city attracts 20,000 students each year from all over the world, which lays a solid talents’ foundation for the knowledge-intensive industry.

3.7 Public Participation and Education

1) Public participation throughout the beginning and end

In the planning process, the government was not only together with the citizens, but also interested in working with some of the action teams, especially environment-related organizations. In some projects they become partners. They remain free, and also was criticized certain decisions of the government.

2) Environmental education offered for Erlangen schools

The following topics are lessons offered: Ecological Waste Management, Water and soil, Reducing consumption, Air pollution, Composting and so on. We also provide tours in the following facilities: hazardous waste, waste transfer station, compost heap, waterworks, sewage treatment plant

4. Conclusions and Critical Thinking for Eco-City Planning and management in China

4.1 Conclusions of Erlangen Case

Erlangen is a city which has a consciousness in Ecology for long years as is shown in Figure 7. It won the German national and international acclaim and awards.



Figure 7: Overview of the city

The case shows us that:

1) An eco-city which is also as a vibrant modern city of science, research and industrial city is not contradictory. It is entirely possible that their advantage can mutually reinforce under the premise of sustainable development.

2) Erlangen example may also be helpful to large and extra large cities, if we assume that people there can also be concentrated within a small living space in their lives and behavior.

4.2. Successful Experiences from Erlangen's Eco-City Planning

4.2.1. Innovations in planning procedure

(1) Specific and attainable goals

The administration of Erlangen sets long-term and short-term objectives, which are both specific and practical, for most planning projects, and implement various strategies for achieving the goals [11].

(2) Dynamic planning process

The urban planning of Erlangen takes the city as a dynamic and integrated complex rather than the static and isolated one, which develops goals and strategies in terms of changing urban environment and makes adjustments in a timely manner.

4.2.2 Garbage is not garbage

In Erlangen, the city is well-equipped with extensive garbage recycling system. Completed infrastructures are built in place to facilitate the recycling behaviors, including providing various size of recycle containers and a easy access to nearby garbage bins.

4.2.3 Cooperation among government, organizations and the public

(1) The government takes a lead in sustainability

What is worth mentioning is that both DGNB buildings and the city hall sever as the administrative offices, and it is the government that set the example to encourage more private or public sectors to construct ecologically.

(2) Public engagement

In Erlangen, the planning project greatly relies on the help of practitioners. The key underlying mechanism is continued public awareness and participation in the planning process. Numerous critical suggestions were put forward in the cooperative workshops by committed citizens and relevant institutions or organizations. What is more, any careful adjustment must be approved by them.

4.3. Critical Thinking for Eco-City Planning and management in China

1) Eco-city: Utopia? Commercial hype? Real estate gimmick?

Few issues have aroused more bitter controversy than the issue of eco-city. Confronted with climate change and carbon emissions, cities around the world implanted the eco-city planning. However, many cities are not the real meaning of ecological city, and some of the measures are just towards limited aspects of the ecological city construction, which is called “Fake eco-city”.

So is eco-city a utopian? It is not the case in Erlangen. For Erlangen’s case, we can do more in China in the future.

2) From eco-city to urban ecology: suggestions and challenges for China:

(1) Establish a land use mode which can support a sustainable urban development:

Land use – Mixture of functions

Mono-functional areas (especially housing areas) without other uses like social infrastructures, maintenance, leisure and working opportunities should be avoided.

Challenge: Some uses cause conflicts especially for different classes.

Land use – Supplement of existing functions in the surrounding places

The development of new areas has impacts on the surrounding.

Challenge: Risk of oversupply

(2) Focus on mobility in urban transportation Systems:

Public Transport:

Public transport is the most eco-friendly mean of traffic apart from the motorized traffic.

Challenge: How to deal with problems of public transport: the overcrowded, slow, delayed and less flexible than a private car.

Accessibility – quality of footpaths/cycling tracks

To develop an area which is very attractive for the non motorized traffic, it is essential, that there is a continuous net of footpaths all over the area with links to the surrounding as is shown in Figure 8.

Challenge: How can attract people to walk this way?

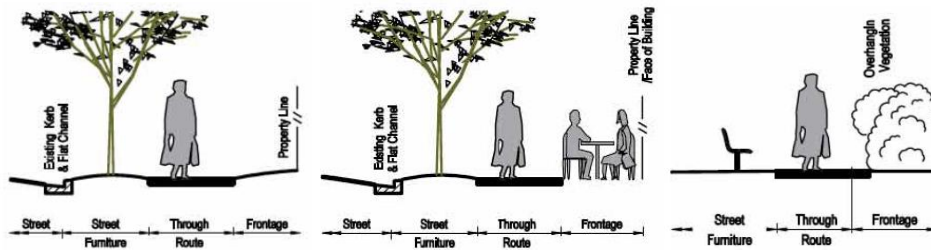


Figure 8: Pedestrian Planning and Design

(3) Green open space and public space never can be ignored

Public space– Space/Location of green open spaces

Green open spaces attract areas especially housing areas and have impact on the microclimate.

Challenge: Too much green open spaces reduce the density of the area. How to coordinate of soft and hard open space?

(4) Encourage public participation

Wide cooperation between government and the public

Public participation is part of “people centered” or "human centric" principles, which have emerged in Western culture for many years. The development of a city has never been without public support.

Challenge: To win the public's trust is an importance for cooperating with them.

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