Eco-City as Approach for Sustainable Development

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Abstract

Eco-City is an essential approach for create sustainable development for the time being .The development aspects of Eco-City must be achieved, and it is one of the most effective way to proceed sustainable development of city. Sustainable development is major to improve the quality of life of the citizens and to reduce the effect of cities upon resources outside the urban context. Eco-cities enhance the comfort of citizens and society through integrated urban planning and management that fully harnesses the benefits of ecological systems. Also Eco-City serves as a fundamental catalyst for change, improving environmental quality of the natural and built environments for future generations, and upgrading conditions for sustainable development, the current situation of environmental problems is more serious than we think. Thus, it is very important for us to turn our eyes to the environment and to find out a positive way to live with nature .Therefore, the paper will present analysis for 4 Eco-City pioneer projects in Europe and Asia and then we will get the main features of those Eco- City projects based on a result of analysis.

Keywords: Eco-City; Sustainable City; Sustainable Development; Planning Eco-City.

1. Introduction

Nowadays, there are nearly 3 billion people living in cities. The UN estimates that by 2050 it will be more than 2/3 of the world population (UN 2012). The rapidly increasing population and trends of urbanization in many world regions today call for a more sustainable form of development. Many city planners, politicians, and environmental groups seeking to create more Ecological sustainable cities have realized the challenges of changing existing community conditions.

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Modern urban areas are based on intergraded complex infrastructure systems to ensure comfort and healthy environment to their residents. Infrastructure systems include electrical, water and waste water, transportation, and sewage networks. The challenge today is to design such systems to be more efficient and effective, and less dependent on fossil fuels. Therefore, renewable resources solutions should be integrated into these complex systems.

Sustainable development is considered as a concept for scientific development, sustainable development needs to alter not only the aspects of economic development, but also desire us to turn the concept of social development. Development of the city as a social development and economic development is an important incarnation of the method of sustainable development and also in proceedings of the concept of renovation. Sustainable management of natural resources requires an integrated approach to closure the cycles of natural resources, energy and waste within cities. The aims of that approach should involve minimizing consuming of natural resources, essentially non-renewable and slowly renewable ones; minimizing production of waste by reusing and recycling no matter where possible; minimizing pollution of air, soil and waters; and increasing the rate of natural areas and bio diversity in cities. The up growth and development of modernistic city has brought major convenience to the people's production and life. moreover, jointly, with the increasing of urban factor intensity and the constant expansion of city size, the problems like the traffic, security and environment and others are growing, too [1]. In detail, the environmental problems of the city are increasingly serious along with the increasing development of city, which not only influences the sustainable development of city, and more Seriously, the large danger to In essence, the city is a socio-economic entity of high concentration of the production and living factors composed of the alternate integration of the natural, synthetic, and socio-economic environment [2].This define the existence and development of the city is limited to consume a great amount of material and natural resources. Meantime, in this process, it will also produce a lot of wastes, which causes a destructive impact on the natural environment, lately leading to the unsustainable development of the city. How to solve those problems? To totally change the traditional philosophy and pattern of urban development, and to implement the development strategy of Eco-City, is the most effective way to crate sustainable development [3].

2. Limitations of research

This research can have policy implications for eco-city anywhere. Through the literature review, an eco-city is going to be conceptualized based on the core values of sustainable development. Best practices of eco-city principles and sustainable development will be introduced and used to analyze several examples. Accordingly, in the examples analysis from various resources an eco-city aspects and objectives are going to be conceptualized based on the concept of sustainability. Eco-City principles related to the process of sustainable development, which can achieve a balance among Urban Form, Mobility, Ecological Industry, economy, and social sustainability.

3. The road from utopia to a sustainable concept

The search for an Ideal City recurs in all cultures and at every level of expression since Thomas Moore's Utopia. The story of the Ideal City can establish criteria and strategies for dealing with the huge and ongoing increases in

urban populations and the new type and scale of problems they pose for planning.

The city is the place where the pulse of new political thought, economic system, cultural, expression and technological has played out with greatest intensity. The idea of sustainability itself owes a good deal to early 20th century thinkers. Idealist thinking reaffirms our values, essential to going beyond the level of limited utility, reasserts their relevance to the particular situation, redefines the dynamic relationships between the various components of urbanism, and recalls the need to constantly rethink the nature of fundamental concepts like sustainability [4].

The Ideal City quest anticipated our current identification of sustainability on the global scale. Although contrasting man-made with natural composition, we must points our attention to the interconnection between natural situation and sustainable urban settlement argued in the Ideal City proposals. That is why sustainable city could be the new term of utopia. Cities hold the potential to maximize the benefits and to offset the negative consequences of globalization [2].

Cities should be places where the interaction and participation of citizens enable them to meet their own needs and aspirations, and those of the wider community, as well as allowing future generations to meet theirs. Over the past decades, urban quality of life has changed. Serious health problems are developing arising from air pollution and noise, and major economic, environmental and social impacts are foreseen because of climate change. While our current way of life provides us with quality of life, at the same it is putting our future at risk [2, 4].

4. Moving Cities towards Sustainability

Sustainable cities have become a highly desired goal for future urban development. However, there are several differentiating descriptions of what exactly a sustainable city should look like. According to the think-tank Sustainable Cities International (2010), a city should adopt city-specific sustainable development strategies in order to foster innovation and advancements within infrastructure and technology, whilst also increasing efficiency gains address how strongly cities and local governments actually can influence the challenges of sustainability. Several obstacles are faced when creating a sustainable city, and the interpretation and implementation of sustainability are shaped by the various forms of governance, which challenges the traditional distinctions between local, national and global politics [4].further argue for long-term approaches that Centre on sustainability, to ensure that cities can better anticipate and cope with rapidly changing conditions.

Cities can be seen as motors used to move towards sustainable development, and the management of these complex systems requires innovative and sophisticated planning tools and concepts [5]. Rather than being independent from one another, [6] state that the existing planning tools and concepts are mutually connected and overlap with each other. This can result in vast confusion in terms of definitions, which in turn complicates the application and usage of such tools and concepts [7]. Identifies four types of sustainable urban forms, and describes how their design concepts contribute towards sustainability: neo-traditional development, the urban containment, the compact city, and the Eco-City [8]. Identifies the three types of developments within our increasingly urbanized habitats as being the digital city, the intelligent city, and the smart city [9]. identify three

solutions for cities moving towards sustainability: knowledge cities, which focus heavily on education, lifelong learning and personal growth; digital cities or cyber-cities, driven primarily by investments from large information and communications technology vendors aiming to enable vast interconnectedness; and Eco-cities, which focus on environmental sustainability through the widespread adoption of renewable resources.

The most important question is how sustainability goals can be put into practice for cities and towns, how to connect sustainability science to sustainable design. In order to look at a "Eco- City", or at a city working toward sustainability, it is important to be realistic, considering the globalized world in which we live. We need to question the existence of such a thing as a 'sustainable city', since no city is an island upon its self anymore, ecological locations of urban regions no longer coincide with their geographic locations, no city can be truly sustainable on its own anymore, as they are no longer self-reliant and their impacts far surpass their land area. Cities can cooperate within their region, nationally and globally and work towards sustainability.

5. Eco-City

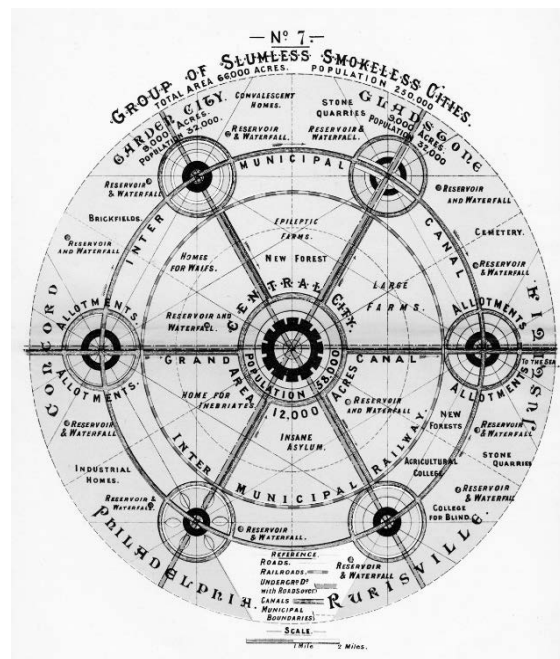### 5.1. Eco–City definitions

Figure 1: Garden City in England designed by Ebenezer Howard.

Source: Howard E., 1902, Garden city of tomorrow.

Modern Eco-City ideology directly originates from Howard's theory of Garden City. The theory of Garden City reveals the ecological charms of harmonious development of a city and nature. A good example of such development is the Letch worth Garden City in England designed by Ebenezer Howard and built in 1903. Howard was the creator of the garden city idea (See Figure 1).based on the theory of three magnets, which addressed the question 'Where will the people go?', the choices being 'Town', 'Country' or 'Town-Country'

[10]. He wanted to combine advantages of living in a city with those of being in a countryside, eliminating at the same time their disadvantages. Now, after nearly a century, it still remains one of the most welcoming environments to live in [11].

The term 'Eco-City' is often traced to Richard Register's (1987) book, Eco-City Berkeley: Building cities for a healthy future. Register describes a city where human beings can exist in harmony with nature therefore greatly reducing their ecological footprint. David Engwicht [12] published Towards an Eco-City, in which he explains how city planners virtually eliminated human interactions by building more roads, shopping malls and increasing dense traffic. For him, a city is a place for inventions to maximize exchange and minimize travel distance [13].

A working definition of 'Eco-City' as adopted by Eco-City Builders and the International Eco-City Standards advisory team (2010), is: "An Eco-City is a human settlement modeled on the self- sustaining resilient structure and function of natural ecosystems. The Eco-City provides healthy abundance to its inhabitants without consuming more (renewable) resources than it produces, without producing more waste than it can assimilate, and without being toxic to itself or neighboring ecosystems. Its inhabitants' ecological impact reflect planetary supportive lifestyles; its social order reflects fundamental principles of fairness, justice and reasonable equity."

Eco-City is also another loosely defined term, and often been used interchangeably with names such as sustainable city or smart city [14]. However, the World Eco- City Summit held in San Francisco in 2008, declared "An Eco-City is an ecologically healthy city. Into the deep future, the cities in which we live must enable people to thrive in harmony with nature and achieve sustainable development. People oriented, Eco-City development requires the comprehensive understanding of complex interactions between environmental, economic, political and socio-cultural factors based on ecological principles. Cities, towns and villages should be designed to enhance the health and quality of life of their inhabitants and maintain the ecosystems on which they depend" (San Francisco Eco-City Declaration, 2008). San Francisco declaration also states that "Eco- City development integrates vision, citizen initiative, public administration, ecologically efficient industry, people's needs and aspirations, harmonious culture, and landscapes where nature, agriculture and the built environment are functionally integrated in a healthy way" [15].

An Eco-City bases on mixing of housing, services and work places. These communities play a high role in climate change mitigation by significant reduction in co2 emissions through buildings, energy and transport infrastructure. Urban planning should enable easy access to efficient public transport connections. Eco-Cities should not be Greenfield developments outside the cities but close to existing infrastructure. Finnish experiences have shown that although the Eco-Cities have better resource efficiency and lower energy consumption in terms of energy used in buildings, the location far away from work places and services cause the need to travel, which in turn cause transport emissions [15, 16]. Therefore, an Eco-City should intensify the current urban structure and thus impact on indirect emissions of construction and use of the community. Urban metabolism features these impacts, i.e. the flows of energy and material. Furthermore, sustainable urban planning and design involves issues such as the utilization of local, renewable energy production methods and eco-efficient water and waste management solutions, as well as the utilization of local terrain and earth masses [11].
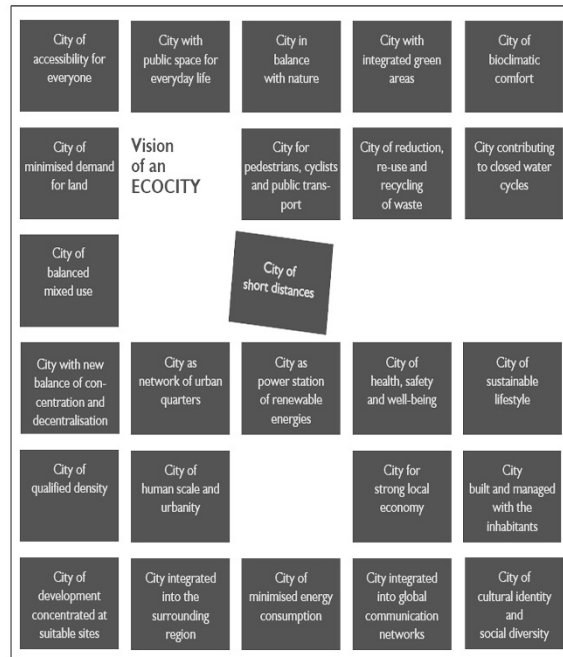
5.2. Eco–City Vision

Figure 2: Vision of an eco-city.

Source: Philine Gaffron, and his colleagues 2005 , Eco-city: A better place to live.

The Eco-City vision not only conveys an overall impression of what an Eco-City can be like, it also aims to promote awareness of sustainable urban planning issues. A vision shared by the people involved helps to focus on a common goal and to guide the steps of development towards an Eco-City. The Eco-City vision comprises features of a sustainable community from all the relevant sectors of sustainable development. In addition to aspects related to the design of the urban structure and the transport system, there are also features relating to energy and materials, a community's way of life and the urban economy. The realization of the Eco-City vision (See Figure 2) and the related goals and objectives thus relies on an integrated planning approach [16].

The focus of the vision lies in the overall aim of the Eco-City project to develop settlement patterns for sustainable cities, emphasizing the implications for an environmentally compatible transport system. It relates to an entire urban community, but is also intended to guide the planning of Eco-City quarters as elements of such a community. These features are interconnected in many ways. To demonstrate the need to balance the manifold requirements of sustainable urban development, two important features have been selected as examples and their connections to other features are shown below [16].

5.3. Challenges to building up an eco-city

5.3.1. Lack of awareness

Because the principles for what an Eco-City is have not been fully agreed, there can be a lack of common

understanding and thus challenging for policymakers to introduce a comprehensive set of policy measures in an integrated manner [14].

5.3.2. Fragmented institutions

While the development of eco-cities requires concerted efforts of many actors, inefficient or insufficient institutions following a sector-based approach may hamper coordination for cross-cutting issues, such as integrated land and transport planning [14].

6. Eco-City and Sustainable Development

6.1. Sustainable Development

During the last few decades, scholars proposed numerous definitions of sustainability. Yet, there is almost no consensus among those definitions found in the sustainable development. The most widely known definition of sustainable development comes from the Brundtland Commission [17], which defines sustainable development as "development that meets the needs of the present without come to terms the ability of future generations to meet their own needs." Since then the definition of sustainability has been improved. Many definitions limit the criteria of sustainability to maintaining ecosystems and natural resources, while others additionally speak of economic viability, social wellbeing, equity, cultural, and spiritual needs. The vision of living within environmental constraints was come in by Daly and Cob [18], where they also define sustainable development as improving the quality of human life while living within the carrying capacity of supporting eco-systems. The sustainability is defined as the overlap between the three dimensions: the simultaneous pursuit of economic prosperity, environmental quality, and social equity [19, 20]. A more exact view of sustainability is that the economy exists within society, and both the economy and society are bounded by their environment [19]. Presently, most of the well accepted sustainable development definitions by the community have to do with living within one's own ecological limits. It understands the correlation among economy, society, and environment, and equitable distribution of resources and opportunities [18, 21].

Eco-cities development has grew as a way to address sustainability issues in the context of cities [22]. The Eco-City Builders expanded upon the definition of the term initially to be focusing on "reshaping cities for the long-term health of human and natural systems" [23, 24]. Therefore, a successful Eco-City takes into consideration the synergy and interdependence of environmental, economic, and social sustainability and their main ability to uphold and strengthen each other in the city context. Developers of the Eco-City need to put in place the basis to enable choices within all aspects of working and living to be sustainable ones.

6.2. Planning the Eco-City

During last years, cities are assuming sustainable development strategies into their urban plans. Table 1 illustrates a brief summary of the leading practices of urban sustainability at several spatial scales. In sustainable built environment process, it is needed to adjust the natural processes and control the scale of human activities; thus, environmental processes require to be integrated with process of planning. This integration is important in terms

of understanding the physical characteristics of the developed areas, also recognizing the technique of the environment, its potential, limitations and threats in the planning process [25].

Long time ago the rise of urban settlements, architects, landscape architects, planners urban theorists and historians have sought methods of combine nature into the built environment. The evolution of ecological planning can be traced back to the early works of many architects and planners [26].

The environmental movement emerged into a broader context In the 1980s. Great technical advances were made in the harnessing of solar and wind energies as renewable sources of power, and many environmentally friendly projects were undertaken. These ideas were extended in the 1990s and resulted in the emergence of the eco-city concept, which aims to create livable and walkable communities. By the beginning of the twenty first century, ecological planning emerged as an expression of a sustainability world-view, which seeks to integrate the human and natural ecosystems. All of the abovementioned theories laid the foundation of the ecological planning theory and they additionally contributed to shaping many other important planning concepts [27, 28].

As stated by Steiner, (2000), planning is "a process that uses scientific and technical information to build consensus among a group of choices". Ecology is the study of interaction between living organisms and their environments. Ecological planning then is defined as the use of biophysical and socio-cultural information derived from this interaction as decision- making opportunities and constraints in the management of ecological systems. Ecological planning is a broad concept based on strategies and methods to create green, safe, vibrant and healthy urban environments [29]. (Roseland, 1997). It is an important planning tool in the establishment of sustainable cities. As stated by Ndubisi, (2002), "ecological planning is more than a tool: it is a way of mediating the dialogue between human actions and natural processes based on the knowledge of the reciprocal relationship between people and the land. It is a view of the world, a process and a domain of professional practice and research within the profession of planning" [27,29].

Table 1: Exemplar best practices on urban sustainability (derived from McDonough and Partners, 1992; Newman and Jennings, 2008; Danish Architecture Centre, 2012; Bio-Regional Development Group, 2012; City of Freiburg, 2012)

Scale	Project	Background	Targeted Sustainability Goals	Project Website
Building	Germany: Commerzbank Headquarters	An ecological skyscraper	▪Provide natural day lighting and ventilation through the sky gardens and operable windows ▪Maximise energy efficiency through double skin facades and the use of water-filled chilled ceilings for cooling ▪Maximise water efficiency through grey water recycling	http://sustainability2009. commerzbank.com/reports/ commerzbank/annual/2009/nb / English/3060/commerzbank-tower_-the-worlds-first-green-building.html
District	England: Cleveleys New Wave Project	A flood and coastal defence strategy plan	▪Break flood waters by building a wave of concrete stairs ▪Waste management by reusing the materials from the old sea wall ▪Provide a pedestrian promenade with a diverse variety of leisure and recreational activities	http://data.prismanet.gr/aspis-case-studies/view.php?id=64 http://www.urbanecology.org.au/ eco-cities/christie-walk

District	Australia: Adelaide Christie Walk Eco-Village Project	An environmentally friendly neighbourhood	▪Reduce energy consumption through passive design, use of heat-efficient materials and vegetation ▪Proximity to services and public transport ▪Waste reduction and recycling ▪Improve water consumption through sustainable stormwater management ▪Provide on-site food production with creation of communal gardens	http://www.advancedfp7.eu/Home/AD-Projects-Map/Model-City-Mannheim
City	Germany: Model City Mannheim (MOMA)	A smart city that promotes energy efficiency by using solar energy and smart control technologies (i.e. Energy Butler system)	▪Connect every household with a smart-energy network ▪Raise the awareness of households about their energy habits and general energy prices ▪Help households to cut their energy bills by using energy efficient technologies ▪Reduce the energy prices	http://library.tac-atc.ca/proceedings/2002/calgary.pdf http://gec.jp/gec/EN/Activities/2005/Eco-Towns/GEC.pdf http://www.greenhouse.org.za
City	Canada: Calgary's C-Train Ride the Wind Program	A wind-powered light rail transit system	▪Provide sustainable modes of transportation ▪Provide a better air quality by reducing greenhouse gas emissions ▪Reduce car dependency	http://ww.ecotippingpoints.org/our-stories/indepth/germany-freiburg-sustainability-transportation-energy-green-economy.html
City	Japan: Kawasaki Eco Town Program	Zero waste industrial ecosystem	▪Reduce greenhouse gas emissions ▪Energy conservation ▪Waste management by turning one's waste into another's raw material	http://www.davidrisstrom.org/100GreenAchievements/100GA-MelbournePrinciples.html
City	South Africa: Johannesburg Green House People's Environmental Centre Project	Community involvement and education with urban gardening and green building principles	▪Provide an environmental demonstration and training centre for the citizens through small community gardens ▪Enhance the quality of community's life by providing them a sustainable living such as organic farming, medicinal herb gardening	http://www.mcdonough.com/speaking-writing/the-hannover-principles-design-for-sustainability/#.VHuxvYun38s
City	Germany: Freiburg Green City	The green and solar capital of Germany	▪Sustainable economy (environmental industry and research, eco-industrial tourism) ▪Sustainable mobility (environmentally compatible modes of transport) ▪The city's resource capital: nature (parks and nature conservation areas, emission control, soil protection, premium quality water) ▪Sustainable urban development (far-sighted planning and citizen participation) ▪Citizen commitment (environment education)	http://www.wpi.edu/Pubs/E-project/Available/E-project-121312-175421/unrestricted/One_Planet_Living_for_WPI.pdf
Global	The Melbourne Principles for Sustainable Cities by the United Nations Environment Programme	Creating environmentally healthy, vibrant and sustainable cities	▪A long-term sustainability vision ▪Economic and social security ▪Biodiversity and ecosystem conservation ▪Minimise the ecological footprint of cities ▪Model cities as ecosystems ▪Provide a sense of place ▪Empower people and foster participation ▪Cooperative networks towards sustainability ▪Sustainable production and consumption ▪Provide a good urban governance	
Global	The Hannover Principles by William McDonough and Michael Braungart	Designing for sustainability	▪Rights of humanity and nature to co-exist ▪Interdependence between humans and nature ▪Respect relationships between spirit and matter ▪Responsibility for the consequences of design ▪Safe objects of long-term value ▪Eliminate the concept of waste ▪Rely on natural energy flow ▪Understand the limitations of design ▪Share knowledge for constant improvement	
Global	The One Planet Living Framework by BioRegional Development Group and World Wildlife Fund	A vision for sustainable world	▪Zero carbon ▪Zero waste ▪Sustainable transport ▪Sustainable materials ▪Local and sustainable food ▪Sustainable water ▪Land use and wildlife ▪Culture and heritage ▪Equity and local economy ▪Health and happiness	

6.3. Aspects of Eco-City development based on the concept of sustainability

Urbanization considered as a result of industrialization and technological progress. However, within the industrialization development and technology advance, the billow in urban population and the growing extension of the scale of city will necessarily rise, too. Although the urban areas records for only 2% of the Earth's land surface, but they generate greenhouse gases 78 percent of the total greenhouse gas emissions. Therefore, the development of urban has a greater effect on climate and environmental change [30]. This effect is mainly from two aspects. The first one, the city's development is bound to occupy a lot of land and consumption other natural resources, and this will undoubtedly cause a certain degree impact on natural ecosystem. The second, the development of city will have a greater effect on the biochemical cycle on the Earth, and this will cause a confirmed extent adverse impact on natural ecosystem, particularly biodiversity, but moreover its impact goes far beyond the range of the city itself [30].

Actually, the main reason causing the previous problems is that, the balanced relevance between the human socio-economic activities and the natural ecosystem has not been handled in a correct way. Because natural ecosystem is the impact of the long-term growth of the nature, so the natural ecological environment is scarce resources limited. In order to achieve the sustainable development of city, we should respect the objective laws of the development of natural ecosystem, and understand the balanced development between the city's socio-economic and natural ecosystem. From a strategic point of view, that is to make ecological strategy as an orientation to achieve the sustainable development of city. The essence of Eco-City development is to achieve the organic balance and sustainability of interactions and returns between the socio-economic and ecological dimensions [31].

In fact, the size and prosperity of city mainly build on the possibility of regional output, energy, resources and environment. Thus, the shortage of urban ecology and the stability of socio-economic system of urban are the most basic factors that determine urban planning and development, and the basic objective of Eco-City development is to mainly solve this problem [32].

The primary issue of Eco-City construction and development is on the premise of respect for the laws of nature, as much as possible to reduce the negative impact of human activities on the natural environment. Precisely speaking, firstly, the planning and development of the city should be built on the basis of material carrying capacity of the natural ecosystem of the region.

Especially on the land use, the protection of biological resources, the natural resource use and the generation of wastes, we cannot be beyond the reality of the allowable limit of natural ecological system, which is the basic requirement of the Eco-City development [30].

Secondly, we should fully use the energy-saving and recycling technologies so that the average of resource consumption is kept to a minimum, in order to ensure the long-term use and the availability of the resources of the field of basic needs like the water resources, energy, foods, building materials and other necessities, etc. [32].

Different issue in the construction and development of Eco-City is that we should effectively guide and adjust the

method of production and life of the city, so as to preserve the steadiness of highly sensitive socioeconomic system of the city. With the development of modern material technology, the convenience has become the basic tools of production and lifestyle what people pursue. Moreover, this appropriateness depends on the basis of many resource and energy consumption, jointly it will also increase the generation of wastes, which will exacerbate the contradictions of the city's energy scarcity and environmental drop.

Thus, it is important to take modern ecological civilization as core values to build economic ethics and codes of attitude, and by it to guide and manage all social and economic activities of the city. This is a critical content of the Eco-City construction and development [32, 33].

Actually, there is some consensus on the basic features of an Eco-City amongst the available definitions. The concept of Eco-City is closely linked to the concept of sustainable development, and the construction of such cities is identified with the implementation of the following 10 tasks: [33, 34].

1. Priorities of land-use must be revised to create compact, green, diverse,   pleasant, safe, and vital mixed use communities close transit nodes and other transportation facilities.

2. Change transportation priorities to favor foot, bicycle, cart, and transit over cars, and to emphasize.

3. Put back damaged urban environments, especially creeks, shore lines, ridgelines, and wetlands.

4. The creation of decent, affordable, safe, convenient, and racially and economically mixed housing.

5. Nurture social justice and create improved opportunities for women, color people, and the disabled.

6. Support local projects in fields of agriculture and urban greening.

7. Promote recycling, innovative technology, and resource conservation while reducing pollution and wastes.

8. Work with businesses to upholding ecologically economic activity while discouraging pollution and waste.

9. Support voluntary simplicity and discourage excessive consumption of material goods.

10. Increase awareness of the local environment within activist and educational projects that will help increase public awareness of ecological sustainability issues.

7. Eco-City Objectives

There are five elements which are relevant to urban planning for an Eco-City objectives: context and the four sectors of urban development: urban structure, transport, energy and material flows, and socio-economy.

These elements each comprise a number of aspects which are used to structure the presentation of the Eco-City Objectives. (See Figure 3)
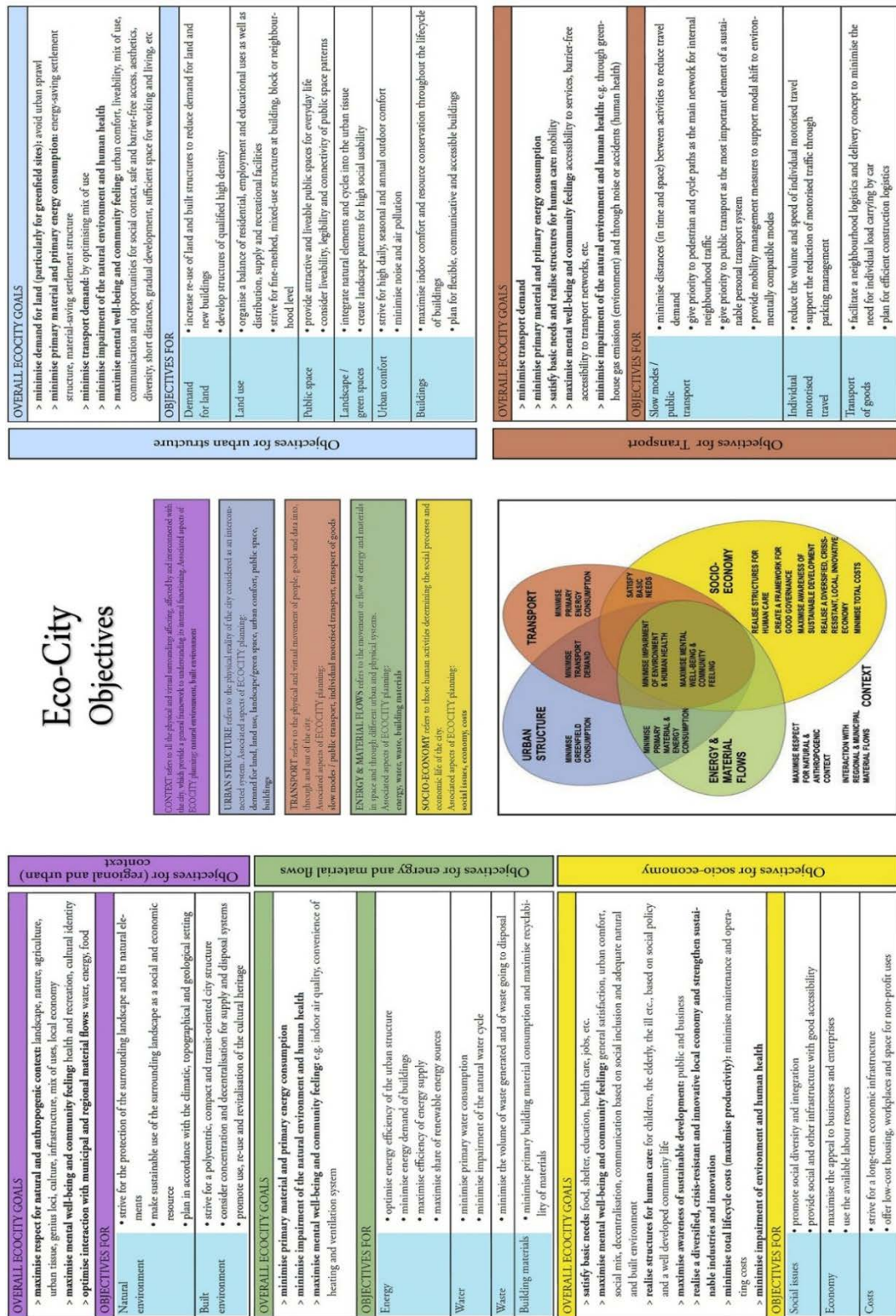
Figure 3: Structuring the overall Eco-City objectives and goals according to the five elements of Eco-City planning.

Source: Philine Gaffron, and his colleagues 2005 , Eco-city: A better place to live.

8. Eco-City Principles

Eco-city is considered as a concept in order to formation sustainable development. Thus, it follows the principles of sustainable development. But Eco-city concept being a branch of the inclusive sustainable development, has a more particular of principles. As the prefix suggests, Eco-City has a strong connection with 'ecology'. What it also built upon is the scale of development, which defines the suffix. An Eco-city According to the Urban Ecology group in Australia, the principles of the eco-city concept can be divided into several topics [27, 28].

8.1. Urban Form

The urban development in idiom of locative and formal growth plays a vital role in realizing the eco-city concept. When Richard Register, the man who first defined the term 'Eco-City' visualized it, Richard considered it to be high density mixed use transit oriented developments. by Looking at the urban form and fabric of highly dense mixed use cities which have living and working within walking distance consume less energy and produce less co2 as compared to sprawling cities. The city of Barcelona can be considered as good example of the first type but on the other hand the latter one the latter one [35].

8.2. Mobility

The mobility issue goes further than solely mobilizing the people when it comes to realizing the eco-city concept. An eco-city works on producing most of its needs like food and other goods to decrease the transportation cost and also to reduce the ecological footprint. Moreover, the eco-city concept promotes the idea to encourage most people use public transportation. The city has to be transit oriented and working facilities and other enjoyment should be within walking or cycling distance. It should discourage the use of private cars that burns fossil fuel and thus reduce carbon emission considering the fact that the transportation system is the majorly responsible for this [27].

8.3. Biodiversity

Eco-city requires to let people to get more close to nature. During its urban development, therefore it has to conserve the natural habitat of flora, fauna and the animal kingdom as much as possible. The Eco-city concept demands the minimum impact on the ecological system in addition to that it promotes people to live closer to nature. That will improve the quality of life and makes sure that the future generation also gets better condition of living. Integrating the nature as a design element in macro or micro scale may reduce energy consumption too [27, 28].

8.4. Ecological Industry

Industries are one of the main icons of an Eco-City. Industrial ecology suggests that the industries within a city or a region to be distributed in such a way that it depends on each other. The formulation of industrial ecosystem maximizes the use of recycled materials in production. The waste produced by an industry is used by another one as a resource and vice-versa. Therefore, it minimizes the dependence on nature to deal with it and risk itself to be

adversely affected. Moreover, an Eco-City has to set emphasis on producing energy and so on creating energy industry. By using natural resources and forces, it has to create an energy producing industry to cater to the whole city [36].

8.5. Economy

It was earlier consider that economic stability is a precondition of city being classified as Eco-City. However, over time the perception has changed and now economy is well incorporated with the Eco-City concept. Eco-city concept requires a long term vision of economic stability as well as a strong vision to make ideal use of the resources available. A modern concept related to Eco-City has recently introduced by the World Bank and Local Government Strategy called (Eco2Cities) synergizing ecological and economical sustainability together. Moreover, it deals with creating ecological initiatives be rewarded and actions that adversely affect sustainability be penalized economically [35, 36].

8.6. Social Sustainability

The society requires to be sustainable for other factors of sustainability to work. The society has to be unleash from any social conflict. All the people regardless of their social or economic situation should have at least their basic needs fulfilled to reduce this contradiction. A society in conflict cannot endure and hence sustain in the future. Although it is very idealistic to expect a society where the distribution of wealth and facilities are equal but at least the society should be able to address the fundamental issues of all. There has to be opportunities in the society to use skills to make money and to enjoy life. Life has to be safe and secure. Social sustainability can help create the steady economy as well as provide the scope to focus more on environmental issues. A less separate society produces an integrated urban society which can be considered to be sustainable for the future [37].

9. Analysis of contemporary eco-city projects

As we previously presented the theoretical background of the concepts of eco-city and its principles. During the following the paper will give analyze selected projects that refer to this concepts, also paper will illustrate characteristics of those projects as a result of analyze. Since approximately 2000 a number of ambitious plans began to emerge for brand new sustainable urban districts and cities. Famous examples include Masdar City in Abu Dhabi, United Arab Emirates, Hammarby Sjöstad in Stockholm and western harbor, Malmao in Sweden, as well as one of Chinese projects, Tianjin Eco- City [38, 40, 41, 42].

This paper presents only 4 eco-city projects (Table 2), in order to reflect their spatial differentiation. Moreover (Table 2) lists each of the selected projects and provides basic information about them. We took into account European as well as Asian and American projects. European projects of eco-cities are much smaller and more modest in comparison to, for example, Chinese Tianjin Eco-City. Each of the projects, despite implementing a common concept, puts an emphasis on different aspects of sustainability [39, 41].

In generally, Contemporary Eco-Cities are conceptualized as an enclosed space through which to measure ecological virtue, such as zero-waste, and low carbon emissions. In sharp contrast to Eco-City proponents who

argue that the only way to measure inputs and outputs is through containing the Eco-City into a particular place, theorists from urban socio-nature, radical geography, and political ecology reject any separation of the "urban" sphere from the "ecological," and hence, the Eco-city from the city itself. Thus, ultimately, we suggest that embedded within the ideology of the Eco-City lie the seeds of its own failure [37].

Masdar City is presented as a vision for expand a renewable energy industry in Abu Dhabi, therefore emphasizes mostly economic issues of sustainable development. Furthermore, for the two projects of Swedish one of the major targets is to reduce by 50% the negative environmental influence compared to standard neighborhoods of the nineties. In planning of the project, one of the main guiding principles was to adopt a holistic approach towards creating and designing a livable, efficient and compact city, which would be developed in an ecologically sound and environmentally sustainable technique [38].

Table 2: Summary of projects analyzed, Marcin Leźnicki, Aleksandra Lewandowska , Implementation of sustainable development on the example of the concept of eco-city, 2014.

Project	Location	Area (ha)	Population	Description	Status
Masdar City (www.masdarcity.ae/en/home)	Abu Dhabi, United Arab Emirates	600	40.000	Masdar City is aimed to be zero-carbon and zero-waste, and to provide home and testing ground for Abu Dhabi's Masdar Initiative, which aims to develop Abu Dhabi as a major energy research centre.	Mostly completed
Hammarby Sjöstad (http://www.hammarbysjostad.se/)	Stockholm, Sweden	200	20.000	In New Stockholm district strong efforts have been made to close the material and energy cycle. When complete the development will have about 10.000 residential units and 350.000 m² of commercial space.	Mostly completed
Western Harbour, Bo01 (http://www.malmo.se/English/Sustainable-City-Development/Bo01---Western-Harbour.html)	Malmö, Sweden	160	10.000	This district of Malmo is built on reclaimed industrial land and has room for 600 dwellings, offices, shops and other services. The development of the district began with the European Housing Expo that was held in Malmo in 2001.	Completed
Tianjin Eco-City (http://www.tianjinecocity.gov.sg/)	China	3.400	350.000	Tianjin Eco-city is a collaborative project between the Chinese and Singaporean governments, which is environmentally-friendly and resource-efficient. The project will be underpinned by educational options and stakeholder engagement to encourage low energy living.	Under construction, completion by 2020

9.1. Features of the Eco- City projects based on a result of analysis

In all of the 4 projects the principles of sustainable development and the basic guidelines for eco-city are implemented. The common features of the projects are [38, 39, 40, 41, 42]:

9.1.1. Innovative, visual and educative Eco-City concept

The Eco-City promotes ecological and innovative city planning principles. The examples created the directions which are the most promising in order to reduce dependencies on fossil fuels in construction and use of built environment. Ecological solutions and their impacts in indicators of eco-efficiency are demonstrated on site in a visual form which is accessible and easy to understand. The systems cover the most important sectors (housing, energy systems, water systems, air quality, biomass growth etc.).

9.1.2. Energy systems

Eco-City aims at zero carbon emissions and energy self-sustainability. Energy systems are rated by the share of renewable energy production and carbon emissions. Assessment indicators are share of renewable energy production, specific CO_2 emissions of energy production.

9.1.3. Water supply and sewage, rain water harvesting

Drinking quality water saving aims at reduced use of natural resources. Two water systems (drinking water and secondary water for,e.g., laundry) enable efficient saving of ground water. Wastewaters are treated locally, and the processes serve for soil enrichment and biogas production. Assessment bases on systems' efficiencies, coverage, and drinking water consumption.

9.1.4. Waste management systems

Waste sorting systems cover the chain from home and work places to waste management site. Efficient sorting is required for possible waste to energy schemes. Reduction of amount of waste is promoted. Assessment bases on number waste fractions, amount of waste, and amount of waste to waste disposal plant.

9.1.5. Eco-City planning for all

Key features of design and planning for all are closeness of services and trip lengths, design for elderly people and children, and minimization of thresholds in pedestrian precincts and public spaces. Safety for all emphasizes no slipperiness in pavement surfaces and low degree of steepness in slopes and ramps. Enough space is needed for wheel chairs in public spaces. Assessment bases on distances from home to services, design solutions.

9.1.6. Pedestrian and bicycle systems

Walking and cycling are supported in all planning and design of the Eco-City. Walking and cycling are separated from motorized traffic. Adequate bicycle shelters at housing and public transport stops are required.

9.1.7. Parking & Site access

Access to Eco-City bases on public, low-cost and low-emission transport. Private car parking is reduced to a minimum in an Eco-City. Parking places for private cars are provided at the zones outside the core of the Eco-

City.

9.1.8. Common spaces and outdoor areas

The area is planned and designed in a way that citizens have individuality and privacy in their private space. In addition, there are semi-public and public spaces. Common spaces provide quality environments to be shared between local citizens in the neighborhood. The concept is based on the cultural and historical Chinese tradition.

9.1.9. Innovative house types

Eco-City offers house types that meet the needs of different user groups. Flexible design is adopted to fit to match with demand of pre-defined customer segments. Desired performance in use and eco-efficiency are achieved with the help of new technology and quality design. The innovative house types combine high quality and high performance in use.

9.1.10. Environmental impacts

Building products and systems are selected based on their eco-performance during the life span. Energy-efficient solutions are promoted, based on their embedded and service life impacts. Local availability of materials and products is considered. Sustainable Eco-City buildings support the Eco-City Brand.

9.1.11. Building Performance

Eco-City buildings are designed, constructed and maintained so that they provide desired performance with minimal environmental impacts during their service life, whilst encouraging economic, social and cultural progress. Performance indicators need to be created for local conditions for assessment of the conformity of selected building products, technical systems and the whole building.

9.1.12. Construction process

Stepwise construction of the Eco-City area is managed in a way that new construction creates as little disturbance to the inhabitants as possible. The neighborhood communicates the feeling of readiness, even though the development is unfinished. Comprehensive planning in the area reduces the unnecessary transport of soil. Citizen participation process in planning, design and development is encouraged by efficient communication.

10. Recommendations

- Achieving sustainable development based on Eco-City approach which is recommended to provide comfort to the occupants, save the running operation costs and at the same time preserve the environmental resources for the next generations.
- Providing avenues for collaboration and delivery of information to residents on a local scale may assist changing attitudes toward sustainable development and raising awareness of how to make Eco- cities.

- Eco-Cities governments should provide the transparency and knowledge rights for their people and share them the importance of decisions which will effect on their present and future.

- Transportation system should be changed in order to make it more livable and sustainable and should not only give people the option of walking, biking and using public transit, in addition to driving, but also reduces traffic congestion, protects the environment, and encourages physical activities. On other hand, Water saving should be managed efficiently to control the waste water throughout the grey water system for buildings and irrigation systems.

11. Conclusions

The City is a reason of many problems for environment. However, cities have solutions for its issues. The city is a regional community consisting of the mutual integration of the natural, artificial, and socio-economic environment. Because it has the features of the high intensity of the population, materials and capitals, space, and activities, so it has the deep-rooted unsustainability. Therefore, it is urgent case to implement the development strategy of Eco-City, and it is the most active way to obtain sustainable development.

The build of Eco-City is an important trend to fix our critical environmental problems and issues. With the creation the natural balance and sustainability of interactions and feedbacks between the socio-economic and ecological aspects is the basis of the Eco-City development. Furthermore the exist of Eco-City, the development of the city implement the vision of sustainable development, to promote the ecological environment construction and repair, achieve the city's development in the pursuit of economic and social benefits can also pay more awareness to eco efficiency, to achieve social, economic and environmental sustainability, harmonious development and proceed the unique relationship between human and nature.

The Eco City is based on conserving the significant environmental values of the area by utilizing brownfields in the development. The Eco City is a human-friendly environment that fits to all population groups. The eco-city projects have the possibility to impact on social interactions and attract citizens in the management of an urban ecosystem. They are engaging for the society because they are about measuring the quality of life.

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