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Going green: Initiatives and technologies in Shanghai World Expo



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ABSTRACT

The sustainable development steers the green city campaign in the global stage, which has become an increasing challenge particularly to most developing countries in the next decades. This paper aims to investigate green-technologies applicable in the process of developing 2010 Shanghai Expo and the implementation of these green technologies in helping Shanghai city achieve building efficiency and sustainability. A list of green technologies applied in the World Expo has been investigated and key effective green technologies have been identified by using a questionnaire survey. This is followed by case studies to investigate the extent to which these green technologies have been applied to achieve the sustainable development of cities. The findings suggest that a paradigm shift in urban planning and building design is needed and proactive financial measures to encourage the application of green technologies should be formulated. The suggestions can help guide the future direction on the practical approaches towards green cities.

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Contents

1. Introduction	78
1.1. Green city practice: initiatives and technologies	79
1.2. Overview of green strategy in 2010 Shanghai World Expo	81
2. Research methods	82
2.1. Evaluation on the effects of the green technologies	83
3. Case study: green effect of Shanghai World Expo	84
3.1. Case 1: theme pavilion of the Expo	84
3.2. Case 2: China National Pavilion	85
4. Discussion	85
5. Concluding remarks	87
References	87

1. Introduction

Today, half of the world's population lives in towns and cities [1]. The level of urbanization, the number and size of the megalopolis in the world are unprecedented. During the past two decades, the rate of urbanization has become so great that large and medium-sized cities as well as extensive slum-like development has occurred [2]. This is particularly true in China. Nearly all of China's population growth in the past 20 years has occurred in cities. Over the past 50 years, the country's urban population has

increased more than seven-fold, from 72 million in 1952 to 540 million in 2004.

Nevertheless, as cities grow, managing them becomes increasingly complex. If well managed, cities offer important opportunities for economic and social development. Cities have always been focal points for economic growth, innovation, and employment. Of particular concern in the process of fast urbanization are the risks to the immediate and surrounding environment, to natural resources, to health conditions, to social cohesion, and to individual rights [3]. However, over the past decades, cities have been seen as the sources of environmental degradation and resource depletion [4–6]. These environmental effects have brought great challenges to cities in the 21st Century. The main challenge, therefore, is not competition among the cities, but the challenge of being sustainable urban development. Few of the

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megalopolis has yet met all those challenges of 21st century – low carbon energy, public health for an aging population, clean water, reduced air and water pollution, effective waste management and resilience to global climate change. This is echoed with the principles of sustainable development practices addressed by the Bruntland Commission Report [7]. The promotion of sustainable development mission has been shaping the practice of all sectors including city development towards sustainable practice, which works for the balance between economic, social and environmental performance. All large cities need to invent new approaches to practice the principles of sustainable development. The promotion of sustainable practice in urban development has resulted in the development of various green technologies especially for improving environmental performance. Sustainable urban development has therefore constituted a crucial element affecting the long-term outlook of humanity [8].

Initiatives favoring sustainable urban development are varied in nature, spanning from information campaigns, solutions for maintaining the quality of built environments, zoning approaches for preserving valuable natural areas and working landscapes to financial incentives and to policies and regulations [9]. The OECD has analyzed regional specialization and cluster strategies as the intersection of three policy families: regional policy, science and technology or innovation policy, and industrial/enterprise policy [10]. One exemplar is the Chicago Metropolis 2020 plan in which public interest goals of sustainable development are met while realizing narrower aims [11]. The Chicago case has demonstrated the strategies from stakeholders that can be used to safeguard the environment, encourage neighborhoods with mixes of building types and housing affordable to a range of incomes, and require inner cities and older suburbs that are compact and walkable [12]. Among the initiatives for achieving the sustainable urban development, green technology is considered as one of the important and effective approaches. And the mega-event is regarded as valuable opportunity to promote the goal of green city. The theme “Better City, Better Life” of the 2010 Shanghai World Expo intends to signal a sustainable urban development future for China. Shanghai World Expo is held over a six month period, from May to October 2010. Shanghai authorities are determined to take this opportunity to promote a greening Shanghai by engaging various green technologies. Shanghai’s commitment to a Green Expo has resulted in significant effects. Many pavilions on display have adopted the environmentally conscious design elements, like energy-efficient heating and cooling systems, recycled building materials, and green wall.

It is necessary to investigate whether or not the green technologies adopted by cities are implemented or to what extent they may help mitigate environmental challenges imposed in the process of urbanization. It appears nevertheless that little study has been conducted on the extent of implementation of applying various green technologies in helping city achieve sustainability. The lack of understanding is considered as one of the critical issues affecting the promotion of sustainable development in urban cities. The paper therefore aims to investigate green technologies applicable in the process of developing Shanghai 2010 World Expo and the implementation of those green elements in helping Shanghai city gain building efficiency and sustainability. It analyzes to what extent Shanghai Expo has caught the essence of sustainable development, and goes on to identify lessons one can learn for the improvement of sustainable urban development. Special attention is given to the examination of the green technologies in two demonstration projects in the Expo. The results can lead to better understanding on the green essence of developing a sustainable city and approaches to achieve it.

The rest of the paper is organized as follows. The following section reviews green initiatives commonly used in urban

development in line with the principle of sustainable development. This is followed by an analysis of the case of Shanghai on the green effects of the Expo. The analysis will be conducted by using the data from a survey and by investigating the extent of effect brought by the green technologies in the two cases. The final section extracts lessons from our empirical investigation and summarizes major concluding remarks.

1.1. Green city practice: initiatives and technologies

Despite various constraints, there has been much headway for propagating innovative, low-cost, and sustainable technologies to mitigate pressing urban problems. This has been made possible by many individuals, communities and organizations. In the previous practices, many researchers, stakeholders, communities, and organizations have been introducing various green technologies for achieving green city. For example, urban planners have adopted various design principles and techniques when designing cities and infrastructures [13]. Developers and contractors adopt various means to reduce collective environmental impacts during the production of building components, construction process, as well as the lifecycle of the building. For example, emphasizes are given to the efficiency of heating and cooling systems [14], green roof technology [15,16], solar systems [17], prefabricated concrete technology [18] and Low-E insulation window technology [19]. These green guidelines for high performance buildings include Energy Star, the National Association of Home Builders’ Green Home Building Guidelines, and Leadership in Energy and Environmental Design (LEED) [20]. The main green technologies that cities employ today were identified through a literature review and can be generally categorized in five broad areas: urban planning, buildings, transportation, urban waste management and urban water management.

1. Technologies for sustainable urban planning:
 - Urban climate modeling technology [21]
 - Spatial information technology (GIS, GPS and GNSS) [22]
 - New observation method and technology (remote sensing, ground observation network) [23]
 - Atmospheric environment assessment [24]
 - Landscape simulation technology [25]
 - Air ventilation assessment [26]
2. Technologies for green buildings:
 - Incorporate energy-efficient design into the site layout and building design to reduce nonrenewable energy use [27]
 - Prefabricated concrete technology [28]
 - Ground source heat pump technology [29]
 - Use local, reclaimed, renewable and recycled materials if possible [30]
 - Cooperative energy efficiency design for sustainability [31]
 - Green roof technology, e.g. sedum transformation of eco-roof [32]
 - Energy-saving windows programs [31]
 - Reduce the urban heat island impact resulting from new buildings and paved surfaces [33]
 - Solar PV panels [34]
3. Technologies and strategies for green transportation:
 - Transit oriented development (TOD) [35]
 - Alternative transportation tool to improve opportunities to utilize public transit [21]
 - Alternative transport fuels (biofuel/electric) [31]
 - Invest in transport systems and infrastructure that reduce dependence on fossil fuel use [30]
 - Neutralize carbon emissions from unavoidable travel [30]

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