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Sustainable urbanization: a bi-dimensional matrix model

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ABSTRACT

The urbanization process is creating dramatic and rapid changes globally, with over half of the world's population living in cities. This rapid urbanization growth has led to the need to understand urbanization as a major contributor to not only economic/social transformation but also resource consumption and environmental damage. In this context, 'sustainable urbanization' came into being. Theoretical debate on 'sustainable urbanization' has been eliminated by the rhetoric and realities of sustainability, while the practical application of this debate to the urbanization process has been both limited and contradictory (Pinches, 1994). From the practical application point of view, many effective urban-rural sustainability practices exist in different situations depending on social, economic, political, cultural development and geographical conditions, which makes it difficult to effectively share the experiences obtained from these practices. It is therefore imperative to establish a fundamental holistic model to share these practical experiences in order to mirror and help transfer the good results already obtained. The aim of the bi-dimensional model for sustainable urbanization is to analyze environmental, social and economic issues in quadrant terms at different stages from a new life cycle perspective of the urban and rural environment. Based on the conceptual model, a Curitiba case is used to demonstrate the way how one of the quadrant I (sustainable urban form) is achieved at city level. It is highlighted that government sponsored urbanization pattern can be efficient. However, practical implementation at city governance/management level is rather more important. This research proposes a roadmap for sustainable urbanization, facilitating the generation of the effective acquisition and sharing of sustainable urbanization experiences to support the decision making processes involved in selecting strategies and solutions. This contribution aims to stimulate innovative methods that are able to cope with current challenging urbanization problems in an integrative manner that is adapted to fluctuating urban demand patterns.

1. Introduction

Urbanization, documented in many academic literatures and reports, has been situated in the context of a transforming economic, social, political, spatial and cultural process.

As cities grow, people invariably move from rural to urban spatial forms. The speed and scale of the urbanization transformation has been presenting formidable challenges, for example, they can create enormous burden to the surrounding environment (haze pollution in China). Over the past 60 years, the world's urbanization rate has increased by 21% and over 50% of the world's population is concentrated in urban areas. It is predicted that this proportion will be close to 60% by 2030 (United Nations, 2010). At the same time, the urbanization rate varies between countries. Some developed countries, such as North America and Europe have a far higher urbanization level (more than 70%) than developing countries such as Asia and Africa (around 40%), but developing countries are experiencing a far more rapid urbanization process since increasing numbers of the population are moving from rural to urban areas. The challenges related to rapidly growing urban populations include meeting a massive need for urban infrastructure, and providing effective municipal and social services while protecting the urban environment. In China, for example, the urbanization rate in 2009 reached 46.1%, and an estimated annual rate of 13–15 million people will be moving into the city in the next 20 years, as shown in Fig. 1 (United Nations, 2010). Since the 1990s, the Chinese urban population has risen by more than 10 million people per year. Over the past 50 years, this has increased more than seven-fold, from 72 million in 1952 to 540 million in 2004.

This unprecedented large-scale urbanization has led to a series of social, economic and ecological challenges. The interests of vulnerable groups have been detrimentally affected by land

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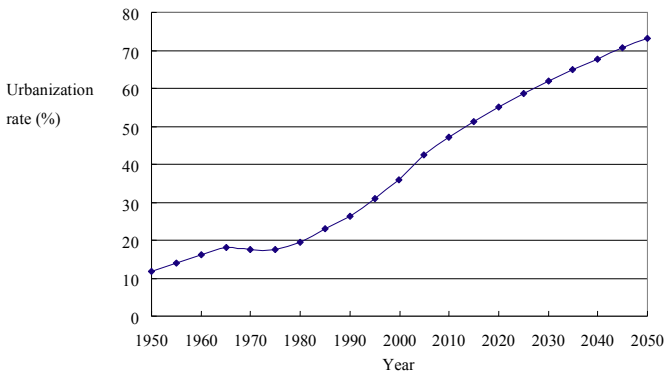

Fig. 1. Urbanization process and prospect in China (1950–2050).
Data source: United Nations, World Urbanization Prospects, 2010.

acquisition or demolition issues, and this has become an important factor affecting social harmony (Bao et al., 2003). Although the annual increase in China's GDP has been no less than 8% since 1992, a number of severe problems have been revealed, many of which can be traced to the lack of a fundamental economic transformation of the economy (Wen, 2005), the large proportion of investment growth (Wu, 2001) and partial environmental improvement without preventing the overall deterioration of the situation.

Such challenges have already generated significant amounts of research to find solutions. Sustainable development as a concept has therefore been well accepted both in theory and practice across various sectors since the Brundtland Commission Report in 1987 (WCED, 1987). In this context, 'sustainable urbanization' came into being, being defined as urbanization practice which complies with sustainable development principles (Shen et al., 2012). Sustainable urbanization is recognized as the main way to address the problems faced by cities in transformation, as it is the cities themselves that provide many solutions (EC, 2006). Since then, the concept of sustainable urbanization has gained significant ground internationally and attracted considerable interest among governments, the public, academics and professionals. In the past few decades, scholars have put forward a few conceptual frameworks in depicting the concept of sustainable urbanization. Drakakis-Smith and Dixon (1997) developed an integrative framework to understand concerns regarding sustainable urbanization from the traditional perspectives including economical, social, political, demographic and environmental performances. Pivo (1996) suggested a sustainable urbanization pattern should be a city being planned as more compact, complete, conservational, comfortable, coordinated and collaborative urban transformation type. One significant contribution from Pivo (1996) is that he put forward a key question about 'sustainable urbanization' as 'whether it will be able to compete in the marketplace?'. Shen et al. (2012) recently put forward an alternative model to evaluate sustainable urbanization by interpreting the relationship between urbanization and urban sustainability. It is nearly the first time that sustainable urbanization as a concept has been quantitatively evaluated. The dynamic nature of the process of urbanization was measured by two parameters, urbanization velocity and urban sustainability velocity which has formed a coordinated matrix in evaluating the current status of a certain that is being urbanized. Early practical attempts at sustainable urbanization are documented in various sources and successful cases of improving the urban sustainability of cities have been identified. Many important initiatives have been made, such as the Urban Management Programme (UN-Habitat, 1990), the Sustainable Cities Programme (UN-Habitat, 1991), Local Agenda 21 Initiatives (UNCED, 1992), the Istanbul Declaration (NATO, 2004), and the World Urban Forum (UN-Habitat, 2010b).

The study of sustainable urbanization has evolved over recent years to increasingly investigate the details of urban and rural forms, function and structure in both qualitative and quantitative terms. A critical review of these frameworks and approaches demonstrates a lack of interpretation of urban-rural dichotomy in the transformation process of sustainable urbanization. For example, what if we consider an urban growth pattern as 'unsustainable' urbanized city or 'sustainable rural pattern'? Until recently, most of the literatures have regarded 'urbanization' as a 'black box' with insufficient emphasis on opening the 'black box' of interpreting the intertwined mechanisms across different stages of urbanization life cycle. It is therefore be imperative to rethink how we can gain from the different matrix process of sustainable urbanization from the fundamental urban-rural dichotomy perspective.

Drawing upon the current state of sustainability research in an urban context, this paper aims to propose a holistic bi-dimensional model to reflect theoretical and practical patterns in sustainable urbanization practices across the life cycle development of rural-urban transformation process. It is more valuable and effective to collect the practical cases in a way that they contribute to the decision-making process when selecting potential strategies and solutions for addressing similar urbanization problems. By establishing a systematic sustainable urbanization mechanism, many alternative solutions for addressing urban problems with their unique characteristics can be identified. In this way, optimal solutions for implementing new sustainable urbanization practices in specific contexts can be identified, which will open new pathways for mitigating the environmental problems of rural and urban areas.

The remainder of this article consists of five sections. The second section presents a theoretical basis to illustrate the 'sustainable urbanization' and urban-rural dichotomy. The third section proposes and describes the design concepts of bi-dimensional sustainable urbanization model incorporating four quadrants' life cycle process. The third section focuses on the methodology of the study and its case study parts. The fourth section offers discussion and analysis for sustainable urbanization case at Curitiba, Brazil. The final section draws some conclusions and suggests several issues for future research.

2. Theory: settlement patterns and sustainable urbanization

2.1. Settlement patterns: urban-rural dichotomy

Urbanization has been referred to as a process (Lewis, 1979; Herbert and Thomas, 1982), in particular a process of spatial diffusion. Spatial diffusion can be demonstrated by the inhabitant space pattern of human beings, and which can be classified in terms of urban and rural forms. The earliest urban-rural dichotomy was defined by the United Nations when it first published population data across the world in, for example, the Demographic Yearbook for 1952 (UN, 1952). According to Lang (1986), the terms rural and urban denote opposite ends of a conceptual continuum comprising real people and communities located somewhere between the two hypothetical extremes of urban and rural habitation space.

2.1.1. Urban

Urban means town or city and refers to both built-up agglomerations and the way of life (Antrop, 2000). Urban areas are created and further developed by the process of urbanization. Dating back to 1930s, Wirth (1938) indicated that

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