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Towards eco-city: the role of green innovation.

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Abstract

Green innovation is fundamental for the transition of city towards eco-city. It enables shifts in the trajectory of city in many different ways. This paper classified green innovation into three types of innovation: green technological innovation; green institutional innovation and green business-model innovation. Under each type of innovation, we go further analysis the working mechanism and the effect to construction of eco-city. Also, this paper highlight some research gap in current study.

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Keywords: green innovation; transition; eco-city

1. Introduction

With increasing concerns about the climate change and energy crisis, it is an tendency for cities all over the world to transit from conventional ones to eco-cities. Eco-city" or "green city", can be defined in various aspects. The UN Environment Program (2012) claims "the key to sustainability lies in the concept of eco-city". What differentiates the eco-city with conventional city is the urban environmental quality and livability which possess the following characters: compact, mixed-used developments, low-energy transportation, renewable energy generation and a reduced overall ecological footprint. Other international organization such as World Bank and Organization for Economic Co-operation and Development are inclined to define it as eco-city as a policy-goal with the concept of "green economy" or ecological modernization.（World Bank. 2010；Hammer，2011）

Green innovation, a branch of innovation study, means the innovation can reduce the assumption of natural energy and improve the energy efficiency that plays such an essential role in the development of society as well as the transition of urban environment. Nevertheless, relatively less attention has paid in

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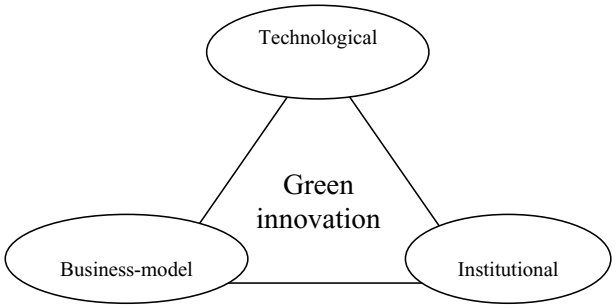
this field from scholars and the mechanism of innovation remains large poorly understand. What's more, current literatures of green innovation primarily focus on the innovation process itself or its economic effect instead of an overall review on its ecological effect to eco-city transition. For example, Sagar(2006) points out that R&D investment cannot result in the innovation in energy sector straightforward in many cases. Based on empirical data from 124 companies, Chiou(2011)draw the conclusion that implementing green innovation and green supply chain can help enhance companies 'competitive advantages facing the challenge in global market.

.Following the paradigm of traditional innovation theory, this paper divides green innovation into three types of innovation: green technological innovation; green institutional innovation and green business-model innovation. The definition of three types of green innovation will be explicated clearly in following parts.



In the following part, part 2 &3&4 are the analysis of three types of green innovation. Part 5 is the discussion about the gaps existed in current study and conclusion of this paper..

2. Technological innovation

The green Technological innovation can be divided into three different types if categorized by the effect: (1) Energy conservation (2) Emission reduction (3) Direct improvement on environment quality, Under each type of innovation, specific examples will be demonstrated to help explain how these innovations help achieve the goal of eco-city.

2.1 Energy conservation

Green technologies innovation that increase resource efficiency (typically fossil fuel combustion efficiency) includes reduce fuel loss, mixing fuel and oxygen intensively, adding additives or catalytic, etc. These technologies can enhance output or effects with the same amount of fuel, thus achieve energy conservation. Another branch of technologies innovation help reduce energy loss to conserve energy that means reducing the impact on the system from the outside. For instance, (Manz, H., S. Brunner, and L. Wullschleger, 2006) investigated heat transfer through evacuated triple glazing, a perspective innovation, and found that it could significantly reduce heat gain and heat loss from the outside if applied to a building. Another research conducted by (Liu, 2006) showed that solar reflective roofs have a higher ability of reflecting sunlight, thus are able to maintain a lower surface temperature and inhibit heat conduction into the building. And according to (Balaras, C. A., et al., 2000) .Adding thermal insulation