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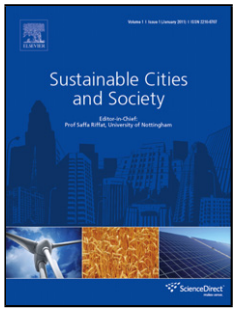

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Authors: Shi Yin, Baizhou Li

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Transferring green building technologies from academic research institutes to building enterprises in the development of urban green building: A stochastic differential game approach

Shi Yin and Baizhou Li*

School of Economics and Management, Harbin Engineering University, Harbin, 150001, China

the correspondence author of the manuscript can be transferred to Baizhou Li who is my tutor of doctoral degree candidates. I am a Ph.D candidate of Harbin Engineering University. My university stipulates the tutor of doctoral degree candidates to be a correspondence author.

*Corresponding author. E-mail addresses: acadch@hrbeu.edu.cn

Highlights

- The paper presents a stochastic differential game of GBTs transfer from academic research institutes to building enterprises in the BACI system.
- Results show that the government subsidy, credit support and tax relief contribute to the GBTs transfer.
- The Pareto optimality of GBTs transfer system can be reached under a cooperative game model.

ABSTRACT

This paper presents a stochastic differential game of green building technologies (GBTs) transfer from academic research institutes to building enterprises in the building enterprises-academic research institutes collaborative innovation (BACI) system. Some random interference factors, for example the uncertain external environment and the mood of decision makers, are considered into three models which are Nash non-cooperative game model, Stacklberg master-slave game model and cooperative game model. The equilibrium strategies of building enterprises and academic research institutes are studied and discussed by using feedback control. The equilibrium results showed that the effort level of academic research institutes and building enterprises is proportional to the government subsidy of GBTs innovation, and the level of credit support and tax relief is proportional to the effort level of academic research institutes. The government subsidy of GBTs innovation is a long-term incentive mechanism which can promote GBTs transfer from academic research institutes to building enterprises in the BACI system. The Pareto optimality of GBTs transfer system can be reached under a cooperative game model. To reach the Pareto optimality, the scope of revenue distribution coefficient is given by analysis of revenue distribution mechanism. This study will contribute to the GBTs transfer from academic research institutes to building enterprises by providing some incentive mechanisms and the scope of revenue distribution coefficient. The findings from this study also adds to theoretical basis of incentive mechanisms, random factors, profit distribution and contract design for building enterprises and academic research institutes to make scientific decisions.

Keywords: Green building technology; Technology transfer; Green building development; Stochastic differential game

1. Introduction

During the development of modern city, buildings (e.g., house buildings and office buildings) play an important role in people's daily life and work (Li et al., 2014; Pajchrowski et al., 2014). Meanwhile, the wide applications of building materials has caused a series of pollution problems in indoor environment and brought a variety of diseases and serious harm to residents health (Hassouneh, Al-Salaymeh & Qoussous, 2015; Hwang, Shan & Supa'At, 2017). Some research institutions conducted a survey and the results reported that buildings account for up to 40% of total energy consumption and nearly 30% of greenhouse gas (GHG) emissions (WBCSD, 2008; UNEP, 2011). Green building technologies (GBTs) has become an important element strategy to solve these

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