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Matching management of supply and demand of green building technologies based on a novel matching method with intuitionistic fuzzy sets

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ABSTRACT Although green building technologies (GBTs) have been advocated to address sustainability issues, their transfer from academic research institutions to building enterprises is still plagued with barriers. For reducing transfer barriers between suppliers and users of GBTs, a practical matching method of the key issues influencing its progress is crucial. While numerous studies have examined the issues influencing GBTs transfer in general, few have been specifically conducted on matching methods for matching supply and demand of GBTs. This study aims to propose an efficient and practical matching decision making method for matching management of GBTs supply and demand based on intuitionistic fuzzy sets (IFS) and considering interactions among aspiration criteria. First, a framework for two-sided matching of GBTs exchange is established. In the framework, IFS theory is used to express the matching aspiration of suppliers and users of GBTs. Moreover, numerous aspirations are transformed into integrated aspirations by intuitionistic fuzzy geometric weighted Heronian mean (IFGWHM) operator considering interactions among aspiration criteria. Furthermore, a two-sided matching model is proposed based on the score matrices calculated using the integrated aspirations. And then the model is converted into a single-objective optimization model by a linear weighted method. Finally, a case study demonstrates that the proposed approach can be applied to real-world GBTs trading and yields matching results that are more consistent with the reality. This study adds to the green building literature by analyzing matching management of supply and demand of GBTs, which could help policy makers take suitable matching measures to improve the success rate of GBTs matching and thereby promote the GBTs transfer from academic research institutes to building enterprises. This research also improves and extends the applications of the two-sided matching theory in the technology transfer paradigm.

Keywords: Green building technologies (GBTs); Matching management; Matching decision making; Aspiration criteria

Highlights

- A novel model is proposed for matching management of GBTs supply and demand.
- The proposed model is proposed based on intuitionistic fuzzy sets (IFS) and considering interactions among aspiration criteria.
- IFS theory is used to express the matching aspiration of suppliers and users of GBTs.
- Precise analysis is performed to demonstrate the comprehensiveness and rationality of the proposed model in this paper.

1. Introduction

In recent years, with the increasing of heat-absorbing greenhouse gases (GHG) like CO_2 into the atmosphere year by year, the atmospheric greenhouse effect has also increased and caused a series of serious problems such as global warming, abnormal climate change, and ozone layer depletion (Ignatius et al., 2016). As to global warming, the increase in GHG emissions over the past few decades has already increased the average surface temperature of the Earth by 0.85 degrees Celsius, and the trend of increasing is expected to continue (Climate Change 2014; Synthesis Report 2014). This is beyond question as buildings account for large amount of global resource consumption and GHG emissions (Ignatius et al., 2016; Climate Change 2014; Synthesis Report 2014; Sandanayake et al., 2016). Buildings play an important role in causing global GHG emissions and they are responsible for more than 40% of total GHG emissions (Xu et al., 2016). Some research institutions conducted a survey which also reported that buildings account for nearly 70% of GHG emissions in Hong Kong and up to 40% of total energy consumption (Chan et al., 2017). Accordingly, reducing GHG emissions produced form the entire