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Assessing co-benefit barriers among stakeholders in Chinese construction industry

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ABSTRACT

The construction industry in China is trying very hard to achieve sustainable development. Meanwhile, it is important to balance the pursuit of stakeholders and addresses the obstacles encountered by these stakeholders. There are few studies that have comprehensively discussed how to combine co-benefits with stakeholder theory to tackle conflicts of interests and achieve co-benefits in Chinese construction industry. This study adopts grey theory to collect and integrate professional suggestions from different experts into indexes that can be compared and analyzed. Then, Technique for Order Preference by Similarity to Ideal Solution is used to rank the stakeholders as well as criteria for selecting the optimum alternative, and uses the crawler technology to gain each criterion's weight for each stakeholder. Our research results show that the stakeholders of suppliers, firms, and the sustainable community are deemed to have priority to achieve co-benefits. The main criteria to consider in achieving co-benefits are transferring technology developments, respecting cultural habitats and traditions, and environment pollution controls. The main contributions are as follows: (1) theoretically, the basis for stakeholders to estimate the co-benefits was obtained (2) the corresponding mixed method to conduct the assessment was developed in Chinse construction industry.

1. Introduction

The construction industry contains planning, design, construction, materials supply, etc. Hence, if a construction project is to be completed smoothly within the specified period and budget, all stakeholders are required to cooperate with each other. However, there arise some common conflicts such as excessive profits orientation for shareholders, ignoring the interests and demands of employees, as well as the unscientific management weight distribution. These conflicts can impede a project seriously, causing an atmosphere of distrust and suspicion, and impacting co-benefits among stakeholders (Graham, 2003). To date, a large number of failures in the field projects have been described; they stem from failure to meet the interests of stakeholders, so achieving co-benefits among stakeholders is a key factor in project success (Kim et al., 2017; Li et al., 2018). The details of theories of stakeholders and co-benefits are included in Section 2 Literature review.

Co-benefits refer to ancillary benefits, which describe a number of equally important reasons and goals that can be accomplished to create a so-called 'win-win' situation that could be achieved by relevant governments' policies or by firms' strategies (Allwood et al., 2014; Kwan and Hashim, 2016). Both the co-benefits and the mitigation strategies to advance the stakeholder's multi-dimensional and complex relationship have been highlighted. It is also important to reduce stakeholders' conflicts of interests, maximize project performance and enhance the society's environmental and resource performance in achieving sustainability (Balaban and Puppim de Oliveira, 2017; Adonteng-Kissi et al., 2017; Yang et al., 2017). For example, firms could control their environmental pollution, and suppliers could improve their production efficiency. By achieving co-benefits, stakeholder theory based win-win strategy or approach is expected to acquire multiple optimal results (Puppim De Oliveira, 2013). It also should be noted that in order to achieve co-benefits, practical and effective actions taken by stakeholders are required.

Most studies attempt to provide theoretical modeling, survey-based approaches, and classical statistical methods for identifying and meeting the interests of all stakeholders as well as addressing the contradictions, normally in a specific project (Park and Lim, 2013; Länsiluoto et al., 2013; Wong and Abe, 2014; Msomphora, 2015). For instance, Länsiluoto et al. (2013) proposed a theoretical model for

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identifying interests that are conflicting among different stakeholders based on stakeholder and resource dependency theories. Although the above studies reported several methods or theories that were used to identify and tackle stakeholders' conflicts of interests, an effective and practical approach for stakeholders to consider co-benefits among stakeholders as a multiple criteria problem and solve co-benefit barriers has not been thoroughly developed and applied in practice (Bustamante et al., 2014; Wang et al., 2016; Smith et al., 2016).

Generally, in the construction industry, there exist different operations and decision makings that can produce various scattered benefit-related data (Wu et al., 2017). This is because the complex conflicting interests could interact among different stakeholders over a relatively long project period, and various demands and interests that required by different stakeholders could be hard to reach a mutual understanding over a series of discussions or debates. The scattered data if properly collected by advanced Big Data techniques such as crawler technology could be used to improve the existing state of the whole construction field (Bilal et al., 2016; Wu et al., 2017). Since then, little research has been efficiently performed by combining stakeholder theory with Big Data techniques to address the barriers existing in the construction industry and to produce the optimum of co-benefits among stakeholders.

In addition, the benefit-related data can be incomplete or disconnected as different projects emphasize different perspectives of interests, causing some demands of stakeholders may be ignored and brining some uncertainties of data. This challenge makes it is difficult to process the data. Grey theory that was proposed by Deng (1982) offers a great opportunity for temporary reference for making decision or strategy when only limited data are available. Compared to other methods such as triangular fuzzy number method (TFN)–although TFN can be used to express the vagueness and the uncertainty of information (Tseng et al., 2018), grey theory requires few data for dealing with multi-criteria systems that lack information (Tseng, 2009) to investigate optimizations among a series of stakeholders and criteria in uncertain situations (Zhai et al., 2009; Bouzon et al., 2018). It has achieved good results in a number of areas, including economic decision-making (Fang et al., 2016) and electrical engineering (Zhong et al., 2017).

As an effective method, Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) has been used to solve multiple criteria decision problems (Peng et al., 2017) and to help decision-makers choose the optimum alternatives. The advantage of the TOPSIS method is that it can assess the effectiveness of ranking problems where information is often incomplete in reality. Due to its characteristics of simplicity and comprehensibility, TOPSIS has been commonly applied in a variety of decision-making problems in various industries (e.g., construction industry) (Liu et al., 2010; Baykasoğlu et al., 2013). As an approach to determine the nearest alternative to an optimum solution, it is thus introduced here to make the data involved in the decision-making process effectively addressed and resolved (Keshtkar, 2016; Onu et al., 2017). This effective method enables identification of the optimal and worst solution (positive and negative ideal solution) out of a set of several solutions. A positive ideal solution is a hypothesis that is used for all values considered and corresponds to the maximum considered in the database. Oppositely, a negative ideal solution is the one that is minimal considered (Peng et al., 2017). By using this negative ideal solution together with the positive ideal solution, any given solution's closest coefficient can be possibly obtained and this given solution can be ranked relatively to other potential solutions.

Therefore, this study uses grey theory integrated TOPSIS with the crawler technology for addressing the conflicts of stakeholders by determining and prioritizing different demands. The grey theory can be used when information is insufficient, and the crawler technology is used to acquire the weights of stakeholders and criteria which are then assessed and determined by experts with much professional experiences in Chinese construction industry, and then TOPSIS can be implemented for the determination of stakeholders' ranking and corresponding criteria summarized in Table 1. These ranks can assist the stakeholder like firms when seeking the co-benefits among stakeholders. Subsequently, the developed methodology is implemented in an experimental case in the context of Chinese construction industry.

Table 1
Proposed evaluation stakeholders and criteria.

Stakeholder			Criteria
AS1	Government	C1	Switching the production structure
		C2	Promoting resources consumption reduction
		C3	Developing relevant sustainable policies
		C4	Upgrading standards and incentive
AS2	Suppliers	C5	Production efficiency improvement
		C6	Creation/use of benefits-sharing mechanisms
		C7	Transferring technology development
		C8	Increase of resilience
AS3	Employee	C9	Health risk assessment
		C10	Increasing employees' income
		C11	Employee education and skill development
		C12	Concerning employees' physical and mental status
AS4	Sustainable community	C13	Respecting cultural habitats and traditions
		C14	Enhancing the knowledge of environmental co-benefit awareness
		C15	Reducing social conflicts
		C16	Access to new financing schemes
AS5	Firm	C17	Environmental pollution control
		C18	Complying with international standards for developing sustainability
		C19	Encouraging participation in decision-making
		C20	Trust and solid relationship establishment

This study has the following aims: provide an effective theoretical basis to assist stakeholders to evaluate co-benefits performance, and propose stakeholders and criteria that can reduce stakeholders' conflicts and achieve co-benefits. These contributions not only contain a theoretical basis to assist stakeholders in solving conflicts for assessing co-benefits but also formulates a quantitative method integrated with crawler technology for this assessment.

This paper is organized in the following way: Section 2 is a literature review related to the theory of co-benefits and stakeholders. Section 3 focuses on the methodology as well as analysis procedures, while Section 4 presents the information of case study and the empirical results. Sections 5 and 6 show the discussion and implications and conclusions, respectively.

2. Literature review

The background on the theories of stakeholder and co-benefits are reviewed. These two theories become a basis of the stakeholders and criteria which are introduced in Section 3.1.

2.1. Stakeholder theory

The stakeholder is defined as "any group or individual who can affect or is affected by the achievement of an organization's objectives" (Freeman, 1984:46). Donaldson et al. (1995) further developed the definition, stating stakeholders as "persons or groups with legitimate interests in procedural and/or substantive aspects of corporate activity." Länsiluoto et al. (2013) pointed out that it was very necessary to identify stakeholders before applying stakeholder theory. Stakeholders usually include a diverse network of primary and secondary stakeholders. The primary stakeholders include shareholders, suppliers, customers, employees, as well as competitors. The secondary stakeholders consist of communities, environmental or social activist groups, as well as governmental or regulatory agencies (Ferguson et al., 2005; Darnall et al., 2009; Freeman et al., 2010). Our study focuses on five major stakeholders, governments, suppliers, employee, sustainable