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ScienceDirect

Procedia Engineering 145 (2016) 234 – 241

Procedia Engineering

www.elsevier.com/locate/procedia

International Conference on Sustainable Design, Engineering and Construction

Development of Social Responsibility Evaluation Framework of Construction Projects: A multi-stakeholders perspective

Pin-Chao Liao[a], Ganbat Tsenguun[a]*, Lore Wenhui Liang[a]

[a] *Department of Construction Management, School of Civil Engineering, Tsinghua University, Beijing China*

Abstract

When performing social responsibility (SR), international contractors can be embraced by project stakeholders, and thus, a sustainable development of construction projects can be attained. However, construction projects involve multiple stakeholders; thus, balancing the interests of all stakeholders is difficult for construction firms. Therefore, an effective rule for decisions related to SR behaviors is important for strategic management of stakeholders. Scholars perform SR studies from various perspectives, emphasizing on corporate management and developing different evaluation systems accordingly. Nonetheless, most of these studies obtain feedbacks from the perspective of general contractors without incorporating the expectations of various stakeholders, and thus, the interpretation can potentially lead to social desirability bias. This study proposes a development framework considering the expectations of various stakeholders for evaluating SR performance. First, global SR metrics were solicited from standards, codes, and legislations. Second, stakeholders were classified, and the metrics were assigned accordingly. A survey questionnaire was distributed to various stakeholders, and responses regarding construction projects were also provided. Third, metrics were selected using the rough set theory and compared with pre-selected metrics with inputs from general contractors. Fourth, an SR evaluation framework consisting of 37 issues was proposed for construction companies to provide guidance for construction corporations to effectively perform SR at the project level. Lastly, a case study was also performed to validate the effectiveness of this framework.

Keywords: construction corporations; social responsibility; stakeholders; rough set

1. Introduction

Social responsibility (SR) is a company's responsibility to meet the needs of stakeholders for their own interest. With the development of the socialist market economy and global economic integration, there is growing concern over the performance of SR from all sectors of society such as the government, media, community, customers, suppliers, subcontractors, and employees. SR is also important for international construction corporations also can enhance corporate reputation. It could maintain the existing market and gain the trust of stakeholders by displaying overdraft report to enhance competitiveness and enterprise development.

* Corresponding author. Tel.:+86-18810259621;
E-mail address: melody_tsenguun@yahoo.com

Peer-review under responsibility of the organizing committee of ICSDEC 2016
doi:10.1016/j.proeng.2016.04.068

Prior studies mainly focused on corporate social responsibility (CSR) issues at the corporate level, such as effectiveness of the CSR policies of a company and impact of CSR commitments on the financial performance of a company. However, a construction corporation is a project-based industry in which projects are normally of long duration, geographically dispersed, and fixed in terms of the time required for completion and outcome of the project.[1],[2]

The management structure of construction corporations is different compared to that of other enterprises. Construction corporations operate at both the corporate and project levels. The corporate level mainly deals with issues related to interactions of the firm within a broader political, economic, social, technological, environmental, and legal context[3] and the project level is concerned with developing a project to comply with company policy. The project level has to maintain the business activities of the company, and a construction company cannot independently exist without projects. Projects are important platforms for construction industries to exercise SR. It is a formal way for contractors to engage with stakeholders; hence, the demands and expectations of both the sides can be concrete on a project. The project-level SR strategy of construction corporations is related to time, which requires a specific SR strategy. Therefore, to ensure that projects are successfully completed in time, the stakeholders involved in the project need to be identified during the course of the project. In addition, the corresponding social responsibilities of each stakeholder shall be clarified. The project-level SR strategy of corporations should be stipulated before the implementation of the project to provide good external conditions for smooth implementation of the project.

In this study we describe the content of SR that non-contractor stakeholders put more emphasis on, which mostly consist of their own interests or the degree of progression of a project. The build evaluation index of corporate SR is often evaluated through an expert investigation method, and project stakeholders are not fully considered. The proposed CSR strategy is a long-term strategy and is not proposed for a single project in process.

2. Definition of Construction Corporations Stakeholders

During the daily operations of construction corporations, there is no unified definition regarding the stakeholders of construction corporations among domestic and foreign experts and scholars, or among their research findings. According to literature related to stakeholders of construction corporations and CSR, different research perspectives, research objects and research methods may make various experts have different definitions regarding the stakeholders of construction corporations. In order to define the stakeholders of a construction corporation correctly, a detailed analysis of existing research findings should be conducted, and stakeholders having the closest relations with the daily operations of corporations should be selected. The statistical results of foreign and domestic literature are listed in Table 1.

According to Table 1, the top eight stakeholders of construction corporations accepted by foreign scholars are stockholders, staff, consumers, suppliers, government, communities where corporations are located, creditors, and managers. The acceptance of stockholders, staff, consumers, and suppliers is higher than 50%, while the acceptance of other stakeholders is lower than 50%. The top eight stakeholders of construction corporations accepted by Chinese scholars are stockholders, staff, consumers, creditors, suppliers, managers, distributors, and government.

Table 1 Stakeholder of Construction Corporations Accepted by Foreign & Domestic Scholars

Foreign		Domestic		18 Chinese construction corporations	
Stakeholders of construction corporations	Referring frequency in literature	Stakeholders of construction corporations	Referring frequency in literature	Stakeholders of construction corporations	Referring frequency in literature
Stockholders	100%	Stockholders	100%	Stockholders	100.00%
Staff	82.3%	Staff	100%	Communities	100.0%
Consumers	79.5%	Consumers	100%	Staff	94.4%
Suppliers	53.4%	Creditors	83.00%	Clients	83.3%
Government	48.3%	Suppliers	79.66%	Natural environment	88.9%

Communities	39.2%	Managers	73.33%	Creditors	65.77%
Creditors	47.5%	Distributors	52.44%	Government	61.1%
Managers	26.3%	Government	48.33%	Suppliers	55.60%

Data source: by searching, analyzing and sorting the literature[1],[2],[3],[4],[5] ,[7],[11],[12],[13],[14],[15],[16]

This study mainly conducted a statistical analysis of stakeholders in research findings related to CSR by domestic and foreign scholars, and of stakeholders performing CSR in 18 famous Chinese construction corporations. Furthermore, actors that influence the smooth implementation of construction corporation projects were considered. This study defined seven types of project stakeholders in construction corporations: funding agencies, communities, government, staff, suppliers, stockholders, and owners.

2.1. Stakeholders in Construction Corporations of Social Responsibility

We conducted literature review and analysis of the relationship between construction corporations and stakeholders, to comply with the objective of scientific principles, the principle of comprehensiveness system, qualitative and quantitative principles, a survey questionnaire was distributed to various stakeholders, and responses regarding construction projects were also provided. We have already distinguish out the 113 CSR issues fulfill by construction corporations.[4]

The principle of scientific objective: when selecting construction corporations, project level indicates CSR strategy. To establish a scientific base, there must be a theoretical foundation. It is necessary to ensure that the selected strategic indicators can effectively characterize the fulfillment of CSR by construction companies.

The principle of comprehensive system: to ensure that the design of indicators includes the interests and demands of all stakeholders, after researching the relevance between various company project stakeholders. The index is screened after determining the weighting between each index.

The principle of operability: to ensure that the screened index concept is explicit or clearly defined, it should reflect the actual problem. In addition, it should be able to be used in the construction of specific projects to use the result of the research to guide practice.

Qualitative and quantitative principles: combine qualitative and quantitative analysis methods, and then use it to screen project-level CSR strategies of construction corporations, The purpose is to ensure that the screened project-level CSR strategy index is capable of satisfy the interests and demands of various project stakeholders, thus providing a guarantee of the construction of specific projects.

3. Method

Based on the above principles and methods, we have already selected 113 CSR issues, which were again screened so that CSR issues that were important for Chinese engineering contracting firms were selected, to look upon as a content framework for fulfilling CSR tasks by engineering contracting firms. Through text analysis and expert interviews, important CSR issues are evaluated and graded and references are then provided. Using the rough set theory, the important SR issues were screened for reducing the number of attributes at the construction project level.

3.1. Rough Set Theory

When screening project-level SR strategies of construction corporations by using the rough set theory, the most important issue is to determine the information system and to build a decision table. There should be a one-to-one correspondence between information system and decision table data. Project-level SR strategies can be selected by the information system of the strategic decision-making process. Based on the rough set theory, the quaternion knowledge presentation system is expressed using $S=(U,\ C,\ D,\ V,\ f)$ [5],[6]. In this system, U denotes the specific project of the stakeholders of a construction corporation and refers to seven stakeholders: funding agencies, communities, government, staff, suppliers, stockholders, and owners. The variable C expresses the condition

attributes of the decision table, and refers to the process of implementing a specific project by a construction corporation to meet the interests and demands of every stakeholder. For instance, the interests and demands of a specific community where the project is implemented includes that the construction process shall minimize the emission of pollutants as one of the main demands. D expresses the decision attributes of the decision table, i.e., the behavior of a construction corporation during the execution of a project. Some stakeholders might adopt measures to protect their own interests; hence, these measures may increase external pressure or resistance on the project. For instance, the construction corporation could reduce its staff to make more profit, and by so doing, it could increase the execution time of a project. The variable V denotes research objects of the information system within the range of values in the attribute set such as the behavior of stakeholders while making decisions during the execution of a project. The variable f expresses the information system in the decision table and the mapping relation of data, i.e., the decision taken by stakeholders with regard to construction behavior in the decision table of data mapping relation.

3.2. Index screening Model Algorithm on the Basis of Attribute Significance Principle of the Attribute Set.[5]

In the rough set theory, the importance of the properties of a research object is evaluated through the weighting of an attribute index, the value of the attribute index weight distinguishes between the role played by the research object attribute; if the value of the weight is greater, it indicates that the degree of contribution of the attribute index to the research object is more important, and vice versa.

In contrast to the decision attribute D, the significance of attributes of condition attribute C of the knowledge presentation system is more. The dependents of attributes is defined by the following equation, where: POS refers to positive, and γ refers to attribute importance;

$$\gamma_C\ D = = \frac{\left|POS_C\ D\right|}{\left|U\right|} \tag{1}$$

Assume condition attribute c_i is a subset of attribute set C of the knowledge presentation system, i.e., $c_i \in C$; after deleting the condition attribute c_i , the significance of the condition attribute set $C - c_i$ for the decision attribute set D of the knowledge presentation system is expressed as:

$$\gamma_{C\text{-}|c_i|}(D) = \frac{\left|POS_C\ D\right| - \left|POS_{C\text{-}\{c_i\}}\ D\right|}{\left|U\right|} = \gamma_C\ D - \gamma_{\{c_i\}}\ D \tag{2}$$

The degree of significance of the condition attribute c_i is not absolute; it is determined by the condition attribute set C and decision attribute set D. The condition attribute set, after deleting the condition attribute, needs to be reclassified, and then the positive region change of U/D is expressed as:

$$k_i = \gamma_C(D) - \gamma_{C\text{-}c_i}(D) \tag{3}$$

The weight of each condition attribute of the information system can be calculated based on functions (1), (2), and (3). The variable w refers to the weight of each condition attribute.

$$w_i = k_i / \sum_{i=1}^{n} k_i \tag{4}$$

An analysis of the degree of importance of the screened system attribute index was conducted. When screening the project-level SR issues of construction corporations, if an attribute from the condition attribute C is deleted, the decision attribute D will be changed. This indicates that condition attributes for decision results are more important;

otherwise, the condition attributes for decision result are not important. Thus, while screening project-level SR issues, important condition attributes should not be deleted from the SR index, and it must be ensured that the project-level SR strategy has relevance in order to balance the interests and demands of stakeholders. The following table summarizes the obtained results.

Table 2 Rough Set-based SR issues for Overdue Construction Project

Issues	S1	S2	S3	S4	S5	S6	S7
Build proper asset management system; maintain assets of owners	0.19						
Disclose information related to operation and financial performance of companies	0.12						
Make sure financial analysis of the project & project schedule is perfect	0.38						
Take “zero casualty” as the final aim of site safety management	0.15						
Respect tangible property rights such as land		0.28					
Construction process and process design should “reduce pollutant emission”		0.40					
Follow working hours rules		0.15		0.04			
Reduce waste during construction and demolition; adopt proper means of waste disposal		0.10					
Keep clean & ordered environment; separate staff & equipment movement		0.07	0.12				
Respect property rights			0.15				
Pay taxes in accordance with the law, free from tax evasion	0.16		0.15				
Senior management will take safety as first priority beyond project objectives			0.28	0.15			
Payoff shall be in strict accordance with labor contract				0.04			
Stipulate unified pay standards and make sure they are strictly implemented				0.11			
Responses to complaints from employees must be effective and private				0.06			
Eliminate child labor				0.10			
Provide a healthy & safe work environment				0.33			
Establish employee social insurance system in accordance with national laws				0.06			
Conduct induction training and regular check of health & safety on staff				0.05			
Effective comparative emergency management flow & safety monitoring system				0.05			
Disclose relevant policy and commitment related to cooperation between companies					0.19		
Disclose company accurate credit, performance ability, and financial indexes					0.27		
Keep effective communication with suppliers/partners; handle dispute on time					0.27		
Ensure construction products meet legal safety standards				0.16	0.27	0.23	0.24
Perfect project schedule; ensure project is completed on time						0.11	0.12
Financial analysis of the project must be perfect; make sure there is no overspending on a project						0.10	0.10
Ensure quality and durability of buildings and its components, reasonable defects liability period, and post-delivery services						0.10	0.10
Provide detailed product instructions to owners, and express important safety information to them by using international symbol as much as possible						0.07	0.10
Reduce potential safety hazard of project to community residents to the greatest extent						0.06	0.10
Follow environmental laws and regulations for construction corporations				0.14		0.06	0.07
Encourage saving energy & resources; advocate utilization of renewable resources & alternative energy sources						0.05	0.04

Establish process and channels that are able to handle complaints and advices from owners effectively	0.05	0.03
Company shall participate in science and technology research and development activities to promote green architectural design	0.05	0.03
Establish good relations with spot supervision engineers and consulting firm personnel	0.04	0.02
Keep good communication relationship with community residents; handle complaints & suggestions from community in time	0.04	0.02
Convey value & idea of the company to the community; keep long-term mutually beneficial relationship with community	0.01	0.02
Participate in community activities; provide proper financial support; establish community welfare facilities	0.01	0.01

* S1=funding agencies, S2=communities, S3=government, S4=staff, S5=suppliers, S6=stockholders S7=owners

A discussion on the rough set basic theory indicates that index screening models can be established on two basis: on the basis of discernible matrix of rough set and on the basis of attribute significance principle of rough set, as well as algorithms. Through an analysis on the applicability of these two types of index screening models, this paper chose to conduct screening of project-level SR issues by using index screening model based on the attribute significance principle of the rough set and the associated algorithms. The screening of specific issues should be conducted by considering the interests and demands of the seven types of stakeholders, i.e., funding: agencies, communities, government, employees, suppliers, shareholders, and owners. Moreover, we screened the 37 important issues for the development of SR evaluation framework of construction projects.

4. Case analysis

To verify the RS-based development rationality of SR evaluation framework of construction projects, we conducted a questionnaire survey at two construction sites—one project was completed on time and the other failed to meet the completion time. The rationality of RS-based SR evaluation framework of construction project is judged on the basis of the survey result. Based on previous surveys of construction project, a few construction projects were completed within the setting time. Therefore, to ensure the selected survey objectives to be with generality, a survey was conducted on two construction projects—one was delayed by a month, and the other was delayed by six months, and the main reasons for delay were explored.

A construction project having a total of four phases in a high-end community of Linhai City was selected as the construction project with one-month delay, and a construction project in an ordinary residential district was selected as a construction project with six-month delay. The survey was conducted by distributing questionnaires to project managers of the construction projects to know the main reasons for the delay of the construction project. We select 17 issues that are the most important to analyze the reasons for delay of both the construction projects.

Table 3 Cause Survey Results of Construction Project Delay

Issues	A	B
Build proper assets management system; maintain assets of owners		
Pay taxes in accordance with law, free from tax evasion	√	√
Disclose accurate information related to operation and financial performance of companies		
With perfect project financial analysis and project schedule; make sure the project to be completed in time and to avoid overspending	√	√
Take “zero casualty” as the final aim of site safety management	√	
Respect tangible property right such as land	√	√
Construction process and process design shall take “reduce pollutant emission” as one of main purposes	√	√
Follow the working hours rules		

Reduce waste during the construction and demolition; adopt proper means of waste disposal and cyclic utilization	√	
Keep clean, tidy and ordered spot environment; staff movement and equipment movement may be separated	√	√
Ensure the construction products meet the legal safety standard	√	√
Payoff shall be in strict accordance with labor contract; shall not be deducted or delayed payroll without reasons	√	
Eliminate child labor	√	√
In response to complaints from employees, build effective and private response & handling mechanism	√	√
Establish employee social insurance system in accordance with national laws and regulations	√	√
Stipulate unified pay standards and shall be strictly implemented	√	√
Conduct induction training and regular check of health & safety knowledge on staff/ Provide healthy & safe work environment		

* √ its mean performed the project-level SR issues; A is Delayed for one month; B is Delayed for half a year.

4.1. Transversal Comparison Analysis.

For the construction project with one-month delay, in terms of SR, the construction corporation performed 13 issues among the 17 issues during the construction of the project. However, for the construction project with six-month delay, the construction corporation performed 10 issues among 17 issues. Therefore, in terms of corporations performing social responsibilities, the performance of the construction project with one-month delay is better than the construction project with six-month delay. According to the survey results, for the construction project with one-month delay, construction corporations performed their social responsibilities positively. Personnel, capital, and raw materials were assigned on time. However, because of the influence of a typhoon, the completion of the construction project was delayed by one month. In construction projects of construction corporations, corporations, finance institutions, communities, government, employees, suppliers, shareholders, and owners form an organic system. During the construction of a project, if the construction corporation fails to perform social responsibilities on time, a chain reaction may be caused because e of violations of interest of the parties involved. Based on the results of the survey on the construction project with one-month delay and the construction project with six-month delay, as well as interviews with project managers, constructions corporations will ensure that the construction process and specific construction operations are in accordance with the stipulations mentioned before the implementation of the project. However, the construction of a project may be hindered because of inadequate supervision or corporations may ignore the stipulations and requirements to meet tight deadlines. In the same time, based on the results of the survey on the construction project with six-month delay and interviews of project managers, another main reason for delay is the arrears of wages of workers during the construction of the project. Frequent arrears of wages may lead to workers' strike, which will severely affect the construction period of the construction project. In addition, when worker's wages are assigned in place, builders may be asked to work day and night to compensate for the time lost, and it may lead to strained relationship between the construction project and the community. The community residents may complain to relevant administrative departments, and siege and intercept the construction project on the site. Finally, it will lead to delay in completion of the construction project.

These results indicate that construction corporations must positively perform social responsibilities to ensure smooth implementation of construction projects, and they validate the rationality of developing an SR evaluation framework on the basis of rough set theory for construction projects.

5. Conclusion

In this study, global SR metrics were obtained from standards, codes, legislations, and project-level SR issues were screened as research objects, by using the stakeholder and rough set theories. Then, we mainly conducted a statistical analysis of stakeholders in research findings related to CSR by domestic, foreign scholars, and on stakeholders performing CSR in 18 famous Chinese construction corporations. Furthermore, factors that influenced the smooth implementation of construction projects were considered. This paper defined 7 types of project stakeholders of construction corporations i.e., funding agencies, communities, government, staff, suppliers,

stockholders, and owners. Metrics were selected using the rough set theory and compared with pre-selected metrics with inputs from general contractors. On this basis, indices were screened considering the interests as demands of stakeholders, using the attribute significance principle of the rough set and associated algorithms. Thus, instructed construction corporations to stipulated project-level SR strategy according to reduction result we summarized 37 issues for SR evaluation framework. This can prevent risk on a project and can also predict requirements of stakeholders. This paper also can provide construction corporations with a better understanding of project-level SR and provide a guide to fulfilling SR.

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