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Who should take the responsibility?

Stakeholders' power over social responsibility issues in construction projects

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Abstract

Construction projects involve multiple stakeholders with different abilities that enable them to deal with the social problems that arise during the project lifecycle. This research aims to study the dynamic stakeholder power in implementing social responsibility issues in construction projects. Empirical research among Hong Kong construction industry practitioners was conducted to investigate the powers of seven stakeholders over thirty-five social responsibility issues. The data was analyzed using two-mode social network analysis methods and processed by Netminer 4. It was found from the results that internal and external stakeholders have control in different domains pertaining to social responsibility issues, but it does not mean either group has superior power. Ranked by the power status on social responsibility issues, the seven stakeholders are classified into five hierarchies: 1) governments, developers, and main contractors; 2) district councils, 3) consultants; 4) non-government organizations; 5) end users. The dynamic nature of stakeholders' powers has been elucidated by describing the power changes in different project stages, as well as in different social responsibility dimensions.

Keywords: social responsibility, stakeholder power, two-mode network

1. Introduction

Social responsibility (SR) in the construction industry has received prevalent academic and industrial attention due to the tremendous influence exerted by construction activities on society and the environment (Loosemore and Lim, 2017). According to the Hong Kong census and statistics department, the construction industry accounted for 4.4% of the national GDP in 2014 and produced 329,900 employment opportunities by the end of 2015. Despite its significant role in the economy, the construction industry has exhibited substandard SR performance compared with the manufacturing and service sectors (Hong Kong Quality Assurance Agency and Hang Seng Bank Company, 2011-2013). Globally, the building and construction sector accounts for 10% of

the energy supply, 30-40% of greenhouse gas emissions, 40-50% of raw material consumption, and 12% of water usage (United Nation Environment Program, 2014). Implementing SR in the construction industry is important because it strives to maintain a balance between economic, environmental, and social goals.

Compared with the prevalence of CSR (corporate social responsibility), SR in construction projects is still an undeveloped field (Zeng et al., 2015). Referring to the definitions by Davis (1973), SR in construction projects means, beyond narrow goals of quality, time, and cost, that project stakeholders should also consider and respond to contemporary social and environmental problems in the project lifecycle. Social responsibility issues (SRIs) are expected to be implemented in construction projects, including measures, policies, or activities addressing environmental and social problems, for example, green building design, recyclable materials, or energy efficiency techniques. Most existing SR literature focusses on individual organizations, while little research has been conducted regarding SR in project environments. Considering the long-term harmful impacts on society and the environment from construction projects, this research attempts to elevate SR from the organizational level to the construction project level.

Construction projects are associated with high uncertainty and dynamics (Aaltonen, 2011). Stakeholders' attributes and positions are changing in different project stages (Aaltonen et al., 2015). The emerging issues that need to be collaboratively confronted by these dynamic stakeholders are also unforeseen (Aaltonen and Kujala, 2016). Stakeholders from multiple sectors need to share their resources and expertise to seek for the best resolutions (McDonald and Young, 2012). Because of the ambiguous distribution of responsibilities, stakeholder collaboration is inefficient. Although some key stakeholders such as developers and contractors are highly emphasized, the roles of other stakeholders such as consultants, NGOs, communities and end users remain unclear (Bal et al., 2013). Project stakeholders possess distinctive resources; the ineffective engagements with the secondary stakeholders may cause the failure of project objectives (Aaltonen and Kujala, 2010). Traditional stakeholder theories focus on organizational efficiency, while inadequate attention has been devoted to the heterogeneous roles of multiple stakeholders for collaborative goals (Heravi et al., 2015).

Power is a sociological concept; it means the capacity of one social actor to change others' behaviors towards one's intentions regardless of resistance (Gaski, 1984). In the model proposed by Mitchell et al. (1997), power is interpreted as one of the salient attributes to prioritize stakeholders' demands. This model has been broadly adopted in stakeholder research, while power as a privilege that should be commensurate with responsibilities, as discussed by (Davis, 1967), is overlooked. Powerful stakeholders hold critical resources to make changes and are more capable of obtaining supports from other stakeholders (Pfeffer, 1992). According to the basic principle of "can" means "ought", powerful stakeholders are supposed to take the leading responsibility in dealing with their capability issues (Enderle, 2006), otherwise the affected stakeholders will have to bear the undesirable outcomes (Loosemore, 1999). Understanding the distribution of stakeholder power is important for the clarification of different roles and responsibilities on implementing SR.

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A dynamic view is needed to analyze stakeholders in construction projects (Turkulainen et al., 2015). Existing research of project stakeholders have been criticized for using a static view (Aaltonen and Kujala, 2016). Evidences from PPP projects (De Schepper et al., 2014), nuclear waste repository projects (Aaltonen et al., 2015), and global projects (Aaltonen and Kujala, 2010) show that stakeholders' power to influence project objectives shifts significantly in different project stages. To address the dynamics of stakeholders, Frooman (2010) argues that stakeholders have stakes over different issues rather than over a focal organization. The lack of research attention on the linkages between stakeholders and related issues is also noted by van Offenbeek and Vos (2016). Rather than only analyzing stakeholder relationships, it is also necessary to find out the structural relations between stakeholders and the diversified issues with which stakeholders are associated (Luoma‐aho and Vos, 2010). This research attempts to connect this linkage to reveal stakeholder dynamics by analyzing stakeholders under the conditions of different SRIs in construction projects.

Regarding the research question "who should take the responsibility?" this research attempts to answer the question indirectly by finding out "who has the power to take the responsibility?". The aim of this research is to investigate stakeholders' power over various SRIs that occur in construction projects, through an empirical study in Hong Kong. Construction industry practitioners from different stakeholder groups were invited to participate in a questionnaire survey. The findings from the questionnaire data analysis revealed the dynamic stakeholder power over diverse SRIs in different project stages. A stakeholder-issue network was built to analyze the dynamic and emergent nature of the project environment. This research can provide a better understanding of the different roles and responsibilities of stakeholders in implementing SR in construction projects, in such a way as to facilitate collaboration among stakeholders from multiple sectors.

2. Literature Review

2.1 SRIs in construction projects

Although the term CSR has received a proliferation of attention since it was introduced in the 1950s, it is still a contestable construct and no universally accepted definition has been agreed upon due to the vagueness and intangibility of the term (Sheehy, 2015). Considering the limited research on SR in construction project contexts (Zeng et al., 2015), this research firstly discusses the definitions for SR and SRIs in construction projects for providing a common ground and maintaining consistency in future study. The controversial aspects of the concept were discussed in this research. Firstly, Freeman and Velamuri (2008) pointed out that all types of organizations should be included instead of only focusing on big corporations. Since construction projects are defined as temporary organizations for completing unique goals by Packendorff (1995), they should also incorporate SR values and respond to social issues besides the traditional objectives of time, cost, and quality. Secondly, the essence of SR is organizations' contemporary morality (Enderle, 2006). Although Friedman (1970) argues business organizations have no duties other than making profits, the moral and obligational nature of SR is broadly supported by political view (Davis, 1967) and social contact theory (Donaldson and Dunfee, 1994). Thirdly, SR does not mean

pure altruism. The motivations of SR initiatives can be a continuum from pure altruistic to pure strategic (Munilla and Miles, 2005). The aim of SR is to seek a balance among multiple organizational goals.

Given the discussions, SR in construction projects is that apart from achieving project goals, project stakeholders should incorporate contemporary social obligations in decision-making, management, and operations over a project lifecycle. SRIs are those issues that are implemented in construction projects, to respond to contemporary social and environmental problems. Brown and Parry (2009) have identified the predominant topics from the annual reports by major construction companies in UK, including environment, resources and energy, sustainability, health and safety, supply chain management, community relationships, governance and ethics. Currently, the specific measure, policies, and activities that are implemented by construction companies to resolve or alleviate these problems have not yet been efficiently addressed.

There are several obstacles for implementing SRIs in construction projects. Because construction projects are unique and temporal unions of multiple stakeholders, responsibilities regarding SRIs in construction projects are unclear. Once undesired consequences occur, stakeholders tend to shirk from responsibility and pass the buck to others. Construction projects involve an extensive variety of stakeholders, representing conflicting demands and interests (Aaltonen, 2011). Such conflicts, commonly existing in construction projects, are even more complicated in Hong Kong due to its dynamically changing social demands and its dearth of natural resources. Driven by self-interest, project stakeholders tend to invest scarce resources towards their individual goals instead of making joint efforts (Cheng et al., 2001). In order to achieve the collaborative implementation of SRIs in projects, stakeholders' roles and powers should be elucidated.

2.2 stakeholder multiplicity and dynamics

The construction project stakeholder environment is characterized by uncertainty, dynamics, and complexity (Aaltonen and Kujala, 2016). In view of the lifecycle perspective, projects involve a changing profile of stakeholders including but not limited to developers, consultants, contractors, subcontractors, suppliers, employees, local communities, financial institutions, government authorities, end users, and NGOs (Heravi et al., 2015). Considering the criticism of traditional stakeholder definitions as too broad to provide managerial inferences, this study tries to narrow definition to the specific context. Adapted from Freeman (1984)'s classical definition, stakeholders in this research specifically refer to the organizations or individuals that can influence or be influenced by the implementation of SRIs in construction projects.

In traditional stakeholder theories, stakeholders are evaluated based on dyadic relationships with focal organizations (Mitchell et al., 1997). Rowley (1997) notes the interactivity of stakeholders by proposing a network model to describe stakeholder interrelationships. Luoma‐aho and Vos (2010) argue that stakeholders should be analyzed based on different issues rather than entire organizations due to the nature of stakeholder dynamics and multiplicity. In the discussion of Neville and Menguc (2006), stakeholder multiplicity means that stakeholders' influences are the manifestations of conflicting, cooperative, or complementary interactions with each other. Instead

of being static, stakeholders' interactions, influences, and interests are complex, heterogeneous, and changing over time (Windsor, 2011).

The complexities of stakeholder interest and power are revealed in several studies. It is commonly agreed that stakeholders have conflicting interests on project objectives (Atkin and Skitmore, 2008). The empirical findings by Li et al. (2012) show that the general public care most about land use and environmental issues and that governments focus mainly on economic growth, while NGOs value the green and sustainable techniques most. Having an interest does not necessarily mean having the ability to accomplish the goals. Bryde and Robinson (2005) indicate that there exist some disparities in stakeholders' interests and real practices. It is because stakeholders with interests do not necessarily have enough power to influence; on the contrary, powerful stakeholders may fail to assume their responsibilities (Loosemore, 1999). Because stakeholder power distribution changes significantly in different project stages, the clarification of it is regarded as a difficult task (Aaltonen and Kujala, 2010). Although some tools have been proposed to analyze stakeholder power, such as the stakeholder matrix (Olander, 2007) and stakeholder circle (Bourne and Walker, 2008), they all fail to sufficiently address the natures of dynamics and multiplicity in stakeholders.

Although the significance of stakeholder dynamics and multiplicity is broadly agreed upon, this topic is only superficially touched by current research in the existing literature due to difficulties in modelling and analyzing (Windsor, 2011). This study attempts to shed light on stakeholder multiplicity and dynamics by evaluating stakeholder power on different SRIs occurring in the project lifecycle. This is also in conformity with the research gaps proposed by (Luoma‐aho and Vos, 2010) , to move from management of stakeholders to the "issue arenas".

2.3 stakeholder power on social issues

There are two reasons for adopting power theory in this research: first, power is the key attribute reflecting a stakeholder's ability to implement certain issues; second, power implies the responsibilities that should be taken by its holders. According to the resource dependence theory by Emerson (1962), social actors possess different resources that are attached to the different abilities needed to accomplish social missions. Powerful actors can get access to the necessary resources to achieve their goals regardless of others' resistance (Cook, 1977). Power has been identified as one of the dominant predictors of a stakeholder's ability to influence project objectives (Bourne and Walker, 2005).

In traditional stakeholder theories, evaluation of stakeholder power is for identifying stakeholders' abilities to threaten or produce risks to the focal firms, so that the managers can strategically respond to conflicting demands (Freeman, 1984). Stakeholder power is one of the most important attributes used to evaluate stakeholders in Mitchell et al. (1997)'s salience model. Another aspect of power that brings the commensurate responsibility taken by the holders is often neglected by most stakeholder literature (Davis, 1967). Loosemore (1999) reported that the imbalance of power and responsibility in construction projects leads to an overload of pressures on stakeholders with relatively low power. It is argued that being useful to managers alone is not enough; the new target

of project stakeholder management should be effective collaboration of all stakeholders with different power and interests (Missonier and Loufrani-Fedida, 2014).

The majority of prior research perceive stakeholder power as a general ability to influence project success. It is argued that due to the dynamic nature, stakeholder power should be evaluated specifically for different issues (Luoma‐aho and Vos, 2010). Construction projects involve a wide range of issues; although some researchers mentioned dynamic stakeholder power over the project stages, investigation of stakeholder power regarding different issues is currently absent. It has been noticed that stakeholder power to influence project decision making varies significantly over different project stages (Aaltonen et al., 2008). Heravi et al. (2015) indicate that owners and developers have power in the project planning phase, and contractors are mainly powerful during the construction stage. Aaltonen and Kujala (2010) propose that the influences of communities, NGOs, and environmentalists are highest in the project planning stage, and decrease as the project progresses. Stakeholder power not only changes over time but also varies under different conditions (Windsor, 2011).

Aaltonen and Kujala (2010) argue not only internal project stakeholders, but external stakeholders can also influence or be influenced by projects' activities. According to Freeman (1984)'s classification, project stakeholders can be classified into two groups: the internal stakeholders are those who have formal, official, or contractual relationships within projects, while the external stakeholders are those who do not have formal connections with major organizations within projects. This research takes a holistic view to investigating the overall internal and external stakeholders' power over different SRIs in construction projects, instead of focusing on several single stakeholders.

3. Research methods

This descriptive research was designed for investigating different stakeholder power on SRIs through a quantitative questionnaire approach. The target of the investigation is the general type of construction project that involves multiple stakeholders and faces challenges to implement the SRIs in a complicated stakeholder environment. The data collection and analysis follow this research scope to find out general perceptions of stakeholder power on different SRIs. The research process consists of three parts: identification of the SRIs and the related stakeholders, data collection, and data analysis.

3.1 Identification of the SRIs and the related stakeholders

The SRIs that are frequently practiced in a construction context, and the related stakeholders, were identified for designing the questionnaire. At first, in January 2015, the 80 SRIs and 12 related stakeholders were extracted by the authors from three sources of materials including academic literature, publications by international organizations, and corporate reports (see Table 1).

Table 1 sources of the SRIs and the related stakeholders

Categories	Sources
Academic research studying	Implementing CSR in the UK construction industry by Barthorpe

SR in construction context	(2010) The development of CSR in the Australian construction industry by Petrovic Lazarevic (2008) CSR and the UK construction industry by Jones et al. (2006) A checklist for assessing sustainability performance of construction projects by Shen et al. (2010) Corporate responsibility reporting in UK construction by Brown and Dacin (1997) A corporate social responsibility indicator systame for construction enterprises by Zhao et al. (2012) CSR activities and impacts of the construction sector by Martinuzzi et al. (2011)
Publications by the international organizations	GRI G4 Sustainability Reporting Guidelines launched by Global Reporting Initiative in 2013 ISO 26000 Social Responsibility Guidance launched by International Standard Organization in 2010 UNEP Greening the Building Supply Chain launched by United Nations Environmental Planning in 2012 CSR Guidelines launched by Construction Excellence in 2004 BRC Project Building Responsible Competitiveness launched by the European Commission in 2010 CSR Index Reports launched by the Hong Kong Quality Assurance Agency in 2008
Annual reports of the world leading construction companies	Annual Sustainability/CSR Reports publicized by Gammon Ltd., Leighton Ltd., and AECOM Ltd from the year of 2005 to 2014

Next, 20 experts were invited including 13 construction management scholars and seven industrial project managers to join a Delphi panel for screening the extracted SRIs. All experts invited have more than 10y experience studying and working in construction projects. From January to March, three rounds of anonymous screening were conducted. The experts were asked to combine or remove the SRIs that they considered as overlapping or unimportant. Feedback was returned to show the contradictory opinions. At last, a list of the 35 SRIs and the seven stakeholders was finalized with less than 20 percent contradiction rate for preparing the questionnaire in the data collection. The SRIs can be categorized into three project lifecycle stages: 1) initiating and planning stage, 2) execution stage, 3) controlling and closing stage. In each stage, the SRIs fall in seven SR dimensions according to ISO 26000: 1) organizational government (OG), 2) human rights (HR), 3) labor protection (LP), 4) environment (En), 5) fair operation (FO), 6) customer issues (CI) and 7) community involvement and development (Co). The related stakeholders are main contractors, developers, end users, governments, consultants, NGOs, and district councils. Using the identified SRIs and stakeholders, the questionnaire was formulated for collecting

practitioners' perceptions of stakeholder power (see appendix).

3.2 Data collection

In the questionnaire, for each SRI, respondents were asked to evaluate how they perceive the seven stakeholders' influences from 5 (extremely influential) to 1 (not at all influential). The term "influence" was substituted for "power", due not only to their similarity in daily usage but also the negative connotation associated with the word "power" (Brass and Burkhardt, 1993). The questionnaire was translated into both traditional and simplified Chinese and was checked by the native-speaking project practitioners for the validation of the questionnaire. From April to June 2015, the paper-based face-to-face questionnaire survey was conducted with the participants of the construction professional courses held in the university (including seminars, workshops, lectures, and tutorials). The respondents were practitioners working in diverse construction organizations in Hong Kong. In total, 120 respondents participated in the survey, and 89 valid questionnaires were obtained with a valid return rate of 74%. The Cronbach's alpha was 0.89, indicating that the questionnaire adopted was reliable. The respondents were experienced practitioners who are familiar with construction practices. Of the overall sample, 34.8% had more than 6y work experience in the construction industry, including 7.9% with over 16y experience. There were 6.7% of the respondents are senior managers, 29.2% are project managers, and 21.35% are site supervisors. The respondents' backgrounds were diverse, including main contractors (n = 35), developers (n = 11), government departments (n = 6), consultants (n = 20), and others (n = 17). Due to the unbalanced sizes, the data was re-weighted by adjustment coefficients to reduce the over- or under-representations resulting from the disproportionate number of different stakeholder groups in the sample. For obtaining impartial results, it was assumed the number of representatives from each stakeholder group should be same as in the target population. The formula for the reweighted coefficients is:

$$\pi_{\mathrm{k}} = \frac{N_k / N}{n_k / n}$$

In the formula, N_k/N represents the proportion of the stakeholder group k in the target population, while n_k/n represents the proportion of this stakeholder group k in the whole sample. The coefficients for the over-represented stakeholder groups who have large a size of the subsample are from 0 to 1. In contrast, the coefficient for the under-represented groups are larger than 1. After reweighting, the final data showed the impartial representations by multiple stakeholder groups.

3.3 Data analysis

The methods of the two-mode social network analysis (SNA) were employed for analyzing the data, by taking the 35 SRIs and the seven stakeholders as two node sets, and the average powers from the questionnaires as the weighted links. The stakeholder-SRI network was developed, depicting relationships between complicated stakeholders and SRIs. SNA has been proposed as a

promising research instrument for construction project management and has produced extensive insights on different topics (Ruan et al., 2013). Emerson (1962) found that by treating both persons and groups as actors in a network, the complex power structures could be analyzed for more meaningful implications.

Most prevalent SNA methods are designed for simplified situations, with only one node set, and links are either present or absent (Opsahl et al., 2010). In this research, the stakeholder-SRI network is a typical two-mode weighted network comprising two node sets, the stakeholders, and the SRIs, between which are the links attached with weighted power. This type of network is rather complicated, and it is inapplicable to normal network measures. The literature focusing on the two-mode network is not extensive, and there is even less on two-mode weighted network analysis. The two-mode networks, also known as the affiliation networks, have become increasingly focused since relationships between two separate groups are common situations in reality (Latapy et al., 2008). Two approaches exist for two-mode data (Borgatti and Everett, 1997). The first approach aims to convert the data to one-mode using a projection or bipartite matrix, after which all fundamental measures designed for one-mode data are available for use. This approach may lead to a loss of information and deviate from the ultimate intention of building a two-mode network. The other approach aims to design a few methods that can be directly used in the two-mode weighted network. Borgatti and Everett (1997) contributed to the latter approach by proposing several measures for the two-mode weighted networks. This research adopted Borgatti and Everett (1997)'s methods. The data analysis in this research consists of three parts.

Firstly, from the stakeholder perspective, the visualization of the stakeholders' power structures over SRIs was conducted through correspondence analysis and spring network algorism. Correspondence analysis is an appropriate alternative for visualizing two-mode weighted networks because it is designed for frequency data (D'Esposito et al., 2014). This is because in a correspondence map, nodes from two groups can be presented in one graph and distances between them are easily interpreted (Borgatti and Everett, 1997). One disadvantage of this method is that the vertices inevitably obscure each other, thereby possibly reducing readability. As a complement, another visualization method, namely, the spring embedding graph layout algorithm, was also used in this research (Kamada and Kawai, 1989). This algorism is designed for generating large-scale network visualization with the optimal layout of nodes and links; however, the distance between nodes is difficult to interpret.

Secondly, from the SRI perspective, the degree centralities of stakeholders in the stakeholder-SRI network were used for presenting dynamics of the stakeholders' power over the different SRIs. The three centralities proposed by Freeman (1978)—degree, closeness, and betweenness—have been extensively used and cited in network analysis research. Rowley (1997) adopted degree centrality to explain stakeholder power status in the network. The degree centrality of nodes was originally defined as the number of adjacent links (Freeman, 1978). A few modifications were necessary on traditional formulas before being applied in the two-mode weighted network. For weighted networks, degree centrality is the sum of the weights of the adjunct edges (Opsahl et al., 2010). For the two-mode networks, degree centralities need to be normalized by the number of

nodes in the other node set, because the nodes can only be connected to the other set of nodes. This research adopted Borgatti and Everett (1997)'s formula to calculate the degree centralities:

$$d_i^* = \frac{d_i}{n_2} \qquad i \in V_1$$

$$d_j^* = \frac{d_j}{n_1} \qquad j \in V_2$$

Where d_i and d_j stand for the sum weights of the edges connected to nodes i and j. n_1 and n_2 are the sizes of node sets V_1 and V_2. d_i^* and d_j^* stand for the degree centralities of nodes i and j.

Thirdly, from the stakeholder-SRI relationships' perspective, hierarchical cluster analysis (HCA) was used to find out the implicit matches between the stakeholder and SRI. HCA can locate the most matched SRIs for each stakeholder by sequentially pairing the variables and producing the highest average correlation as a new cluster (Bridges Jr, 1966). HCA is one of the clustering techniques adopted by the two-mode network analysis. It is found to provide more compatible results compared with other clustering techniques such as the block model approach (Breiger et al., 1975). A reputable commercial software, Netminer 4, was employed for performing the analysis process in this section (Maloni and Brown, 2006).

4. Results and Discussion

4.1 From the perspective of the stakeholder

4.1.1 Stakeholder domains

The correspondence coordinate system (Figure 1) shows the macro view of the distribution of power domains among the seven project stakeholders (square points). (1) The stakeholder nodes are located nearby if they have power over similar SRIs. (2) The SRI nodes are located nearby if similar stakeholders are powerful to them. (3) The stakeholders and SRIs are near each other if they have a considerably strong power relationship. In figure 1, the internal and external stakeholders are automatically separated by the vertical axis due to the distinctive dominated territories on SRIs. The internal stakeholder group includes main contractors, developers, and consultants who have formal or contractual relationships within projects. They have primary power on the SRIs concerning the internal management of construction projects, such as the health and safety issues (H&S), stakeholder meetings, green procurements, and codes of ethics. It is noteworthy that main contractors were closely connected to all H&S issues over the entire project stages. On the other side of the axis, the external stakeholders include governments, NGOs, district councils, and end users. The SRIs they have power over, are related to the externalities of construction projects, for instance, environmental and sustainable issues, community issues, human rights, land use, ecosystems. The separation of the SRI domains indicates that the internal and external stakeholders have power over distinctive scopes in the social issues in projects.

Figure 1 Correspondence mapping of stakeholder–SRI network

4.1.2 Stakeholder power hierarchy

The spring embedding network (Figure 2) displays the overall stakeholder power hierarchy on SRIs. The power status of a stakeholder is reflected by the size of the node representing the value of degree centrality in the network. The links are bundled to reduce the overlapping lines and enhance readability. The three most powerful stakeholders in the middle—governments (d.c.[1] 3.78), developers (d.c. 3.52), and main contractors (d.c. 3.40)—form the core authority, who have power over almost all of the SRIs. The remaining stakeholders, with relatively smaller nodes, have power over only limited scopes of the SRIs. Table 2 shows the hierarchical responsibility distribution among the stakeholders. The three core stakeholders constitute the first tier of powerful stakeholders, and they have power in all of the SRIs. The second tier of powerful stakeholders contains the district councils (d.c. 3.05). As representatives of local communities, they have power in most community issues, as well as environmental and HR issues such as stakeholder platform, project impact disclosure, waste control, and protection of migrant workers. Consultants (d.c. 2.95) are the third tier of powerful stakeholders. They possess the technical and professional knowledge, which generate the power to influence and conduct environmental design, environmental management system, environmental feasibility, and green procurements. NGOs (d.c. 2.90), at the fourth tier, are less powerful. They have the power to call for waste control, non-polluting demolition, and transparent climate in construction projects. At last, end users (d.c. 2.87) are in the fifth tier, have the power to drive the development of stakeholder platforms, environmental design, and impact disclosures.

[1] Abbreviation for degree centrality stands for the stakeholder power status on the SRIs

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Table 2 The stakeholder power hierarchy on SRIs

Power hierarchy	**Stakeholders**	**The SRIs that under power**
1st Tier	Governments; Developers; Main Contractors	All SRIs
2nd Tier	District Councils	Non-disturbance on locals; protections for locals; relocation and compensation; community development plans; stakeholder platform; environmental feasibility; eco-friendly land use; disclosure of impacts; waste control; protection of migrant workers; HR policies
3rd Tier	Consultants	Environmental design; Environmental management systems; Environmental feasibility; Green procurement
4th Tier	NGOs	Waste control; non-polluting demolition; transparent climate
5th Tier	End users	Stakeholder platforms; disclosure of impacts; environmental design

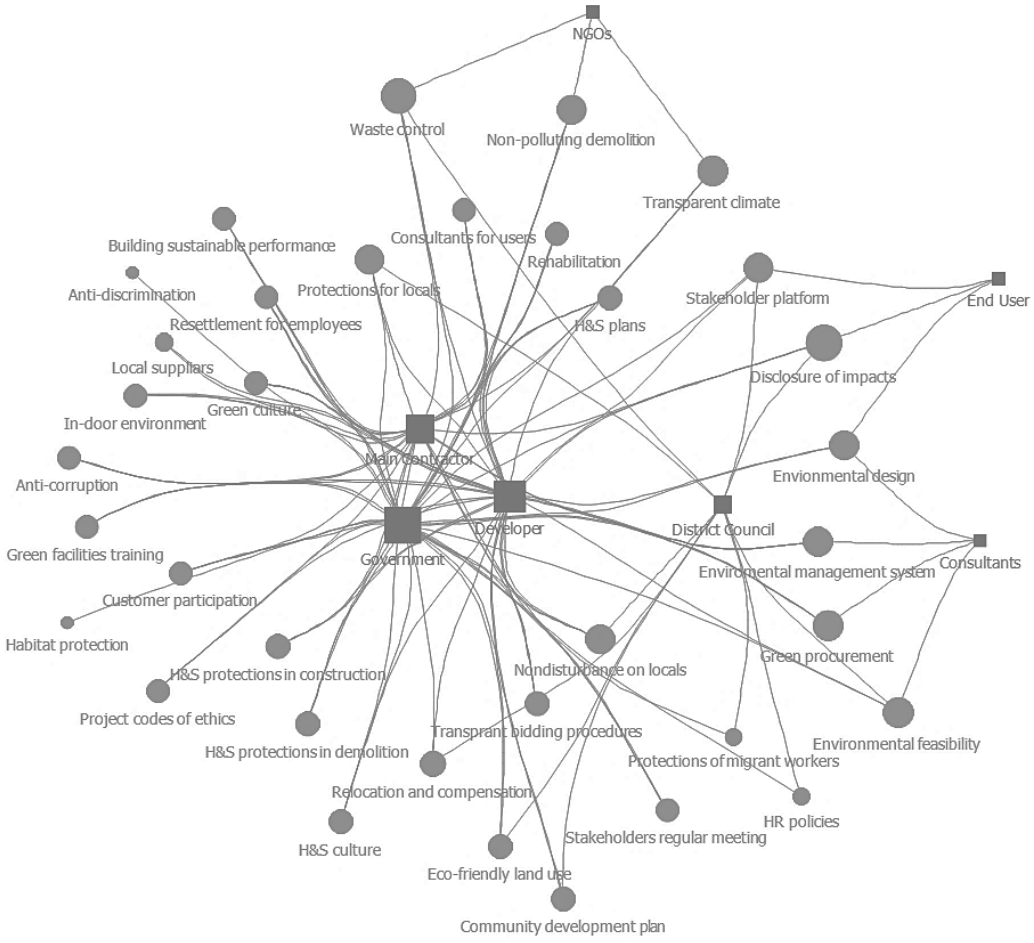

Figure 2 Stakeholder-SRI network based on spring embedding graph layout algorithm

4.2 From the perspective of the SRIs

4.2.1 Stakeholder power fluctuations along the project lifecycle

From the lifecycle perspective, stakeholders' power is changing in different project stages. Figure 3 shows the fluctuations of stakeholder power status from project initiating and planning, execution, to the controlling and closing stage. Power status in different project stages is reflected by the stakeholder's degree centrality on the SRIs under each project stage. Among the three core stakeholders of the first tier power hierarchy shown in section 4.1, governments and developers are most powerful during project initiation and planning stage, but the power decreases gradually as a project progresses. On the contrary, main contractors have little power in early stages but become the most dominant in project execution stage. Apart from the three most powerful stakeholders, the consultants' control over SRIs is relatively high in the planning and execution stage and drops to the lowest in the project controlling and closing stage. Instead of being involved in a project's early stage, the power of NGOs and district councils gradually increases and reaches the highest in the project controlling and closing stage. It is interesting to note that although the

end users' average power is low, they have considerable power in the beginning and ending stages, while having least power in the project execution stage.

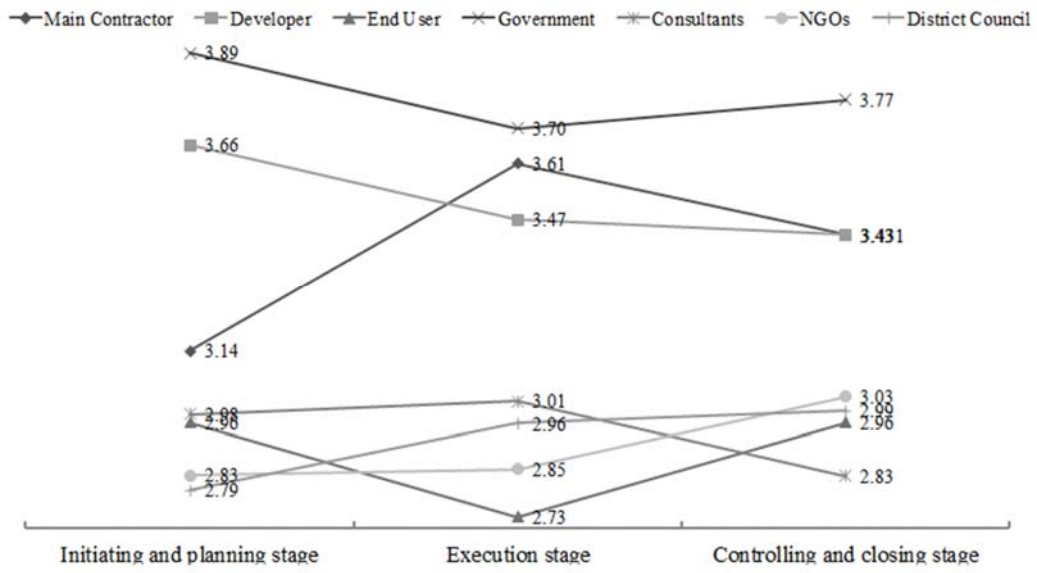

Figure 3 Stakeholders' power fluctuations on SRIs over project lifecycle

4.2.2 The stakeholder power profile on SR dimensions

With regard to the variations of stakeholder power on different dimensions of the SRIs, Figure 4 shows stakeholders' different profiles of power on the SRIs under the seven SR dimensions listed in section 3.1. It illustrates stakeholders' power advantages and weaknesses in implementing the different SRIs. It is shown in Figure 4 that governments have the exclusive power over human rights issues, which is a weak spot for the other stakeholders. Compared with others, developers have superior power on almost all the seven dimensions, and particularly those concerned with community development and organizational governance. Contractors exhibit strong power advantages over labor protection issues, which shows conformity with the results of the coordination analysis in section 4.1. District councils have power advantages on SRIs that are closely related to the wellbeing of regional residents, including the community, human rights (only less than the government), and environmental issues. As the end consumers of constructed buildings, the end users have a power advantage on customer issues.

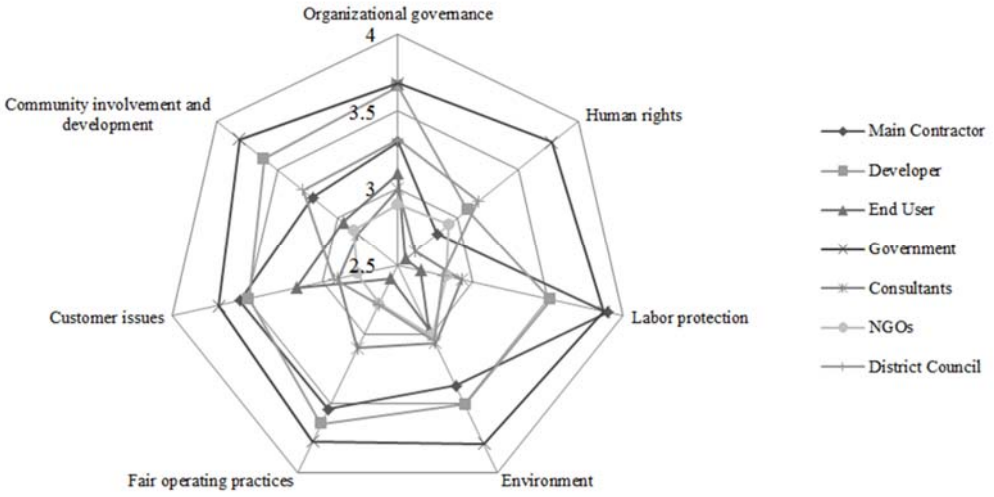

Figure 4 Stakeholders' power profile concerning SRIs in different SR dimensions

4.3 From the perspective of the stakeholder-SRI relationship

The maximum matches between the stakeholders and the SRIs are detected by the HCA method. The results paired each stakeholder with the most suitable SRI to lead and prioritize. Table 3 shows the results indicating that HCA has the best effect if the stakeholder implements the corresponding SRI showing on the right column.

Table 3 the maximum matches between the stakeholders and the SRIs by HCA

Stakeholders	The most matched SRI
developers	Disclosure of impacts
government	Relocation and compensation
District Council	Community development plan
End user	Stakeholder Platform
NGOs	Transparent climate
Main contractors	H&S protections during construction
Consultants	Green procurements

5. Discussions

The implementation of SRIs in construction projects is complicated, due to the dynamics and multiplicity of project stakeholders. According to Aaltonen and Kujala (2016), project stakeholder analysis requires a systematic understanding of the complexity, uncertainty, dynamism, and institutional context. It is necessary to clarify where multiple stakeholders' powers lie, considering the imbalanced power and responsibility observed in construction projects (Loosemore, 1999). Because previous research mostly evaluated stakeholder power as a general attribute, this article

highlighted the dynamic nature of stakeholder power and provided a more sophisticated understanding of stakeholder power by linking stakeholder power and SRIs in construction projects.

Based on the proximity of stakeholder relationships with projects, stakeholders can be divided into the direct-internal-contractual and the indirect-external-public groups (Zeng et al., 2015). It was found from the results that stakeholders from the two groups have distinctive domains on the SRIs. The internal stakeholders were dominated on the SRIs that related to project internal management because they share the critical materials, human resources, technical know-how, and experiences to implement these SRIs in projects. On the other hand, the external stakeholders had power over SRIs concerning the wider society good, including environment, community and human rights. Besides the legitimacy of the external stakeholders associated with their roles in society, end users' potential to withhold purchase is also the source of power to initiate social issues in projects. The SRIs under the external stakeholder domain are mostly philanthropic and altruistic in nature, needing external pressures to drive them. The public governance including public policies, governments, and media are demonstrated as indispensable in facilitating SR when companies do not voluntarily engage (Bovaird, 2005). Compared with the intensive attentions on internal project stakeholders, the power and influences of external stakeholders are more important, especially in social issues (Aaltonen and Kujala, 2010).

There is a common misunderstanding in general perception that the internal stakeholders have a greater power to influence all project objectives. It is not always the case in social issues, because this research showed the three stakeholders in the first level of power hierarchy include governments, main contractors, and developers. As external stakeholders, governments were the most powerful stakeholders to put forward the SRIs because they hold the direct institutional legitimacy to enact policies to encourage good behavior and penalize misconducts. They play the role as the referees, like in any competition game. Developers make decisions on initiating the SRIs because they possess the direct power to set requirements and bear the additional costs. They are the goalkeepers. Main contractors have the power to put the SRI initiatives into practice because they control the coordination of resources and activities in construction projects. They are more like players in the game. The power of the three core stakeholders generates from not only their abundant resources but also the central positions in the network to interact with others. Maignan et al. (2002) pointed out that stakeholders' power to deal with social issues is not only determined by resources, but also by the abilities to communicate with others to coordinate their advocacy. This explanation is in conformity with resource-dependence theory (Emerson, 1962) and stakeholder network theory (Rowley, 1997) indicating that the sources of stakeholder power are both critical resources and network positions.

The three core stakeholders' powers are not consistently high during project lifecycles, which conforms with the emergent and dynamic nature of construction projects (Missonier and Loufrani-Fedida, 2014). The results indicated that the governments and developers had the highest power in the project initiation and planning stage. Their power decreased significantly in the project execution stage. This result echoes the conclusion of Shen et al. (2010) that governments

and owners play significant roles during a project's inception and design stage. Main contractors have nearly no involvement in the project planning stage, especially in traditional design-build projects. They became the commanders in the construction stage because they control the operations on site, executing the project, and coordinating important resources. The specialty of the contractors on health and safety issues in construction projects was evidently observed from the results. The reason for this result is that main contractors are the dominant player during the construction process. They have a vital role in preventing the employees, neighborhoods, publics from the health and safety risks emerging from construction activities. The power advantages are also decided by the substitution of the resources held by the stakeholders (Emerson, 1962). Consultants have advanced knowledge and valuable experience in environmental design, sustainable materials, and advanced techniques. They have the potential power to give SR advice to project decision-makers from a professional perspective. Although consultants have a significant role in proposing SRIs in projects, they do not have adequate power to implement them in projects because they need to obey the decisions of their clients (Othman, 2009).

No research has drawn attention to the role of district councils on SR in construction projects. District Councils are regional offices representing the benefits of local communities in eighteen regions in Hong Kong. Rather than being official or governmental departments, district councils have similar responsibilities to the community committees. Community power has been addressed in previous literature as an important part of external pressures for SR (Thornton and Leahy, 2011). District councils are obligated to defend the interests of the local communities, and they have the legitimate power to supervise the behavior of construction companies working under the regions. They act as the communication bridge between the governments and the local people. This research shows district councils in Hong Kong act as the agents for communities to advocate legitimate requirements in construction projects. In much literature, NGOs are regarded as one of the most important driving forces for SR introduction and implementation (Thijssens et al., 2015). In Hong Kong, there are numbers of NGOs established for almost every social issue with different scales and influences. It is noted from the results that NGOs have limited influence on the SRIs in construction projects. However, NGOs can reinforce their power through allying with governments and big corporations (Hendry, 2005). Another interesting point is powers of the district councils, and the NGOs on SRIs are increasing from project beginning to end, which is opposite to the proposition that the power of communities and NGOs decreases as the project proceeds (Aaltonen and Kujala, 2010). The majority of the carbon emission of buildings is produced during project operation stage, so district councils and NGOs can continuously monitor the project social and environmental influences after the key stakeholders' exit from projects.

In SR research in the general management field, consumers or end users are regarded as significant external pressures for SR implementation (Chernev and Blair, 2015). Because they create demands for SR products and have abilities to withdraw money for unsatisfactory SR performance, their powers are essential for influencing project objectives (Henriques and Sadorsky, 1999). It was found from the results that end users are ranked at the bottom of the power hierarchy in driving the SRIs in construction projects. The finding shows that although in Hong Kong public participation in mega projects is highly emphasized by the government, the bottom-up power to

promote SR is still inadequate. Li et al. (2012) found that the public in eastern culture countries is less likely to engage in project decision-making owning to the traditional culture of compliance. It calls for a development of communication channels or stakeholder platforms for project users to put forwards their demands.

By clarifying stakeholders' roles and responsibilities in implementing different SRIs, this research extends stakeholder and issue management to a collaborative view. Current research that connects stakeholders and their issues focuses on managing intertwined issues across stakeholders. This research aims to solve the problems of "social issues" rather than "stakeholder issues" as distinguished by Clarkson (1995). Stakeholder issues are raised by stakeholders during their stream of experiences in construction projects (van Offenbeek and Vos, 2016). Rather than competing interests that need trade-offs by managers, SRIs require collaboration among multiple stakeholders to achieve common goals. This research addresses the complexity of the stakeholder environment for the improvement of collaboration effectiveness among stakeholders from different sectors to implement SRIs or cope with unforeseen issues in construction projects.

This research also supplements current multiplicity theory. In Rowley (1997)'s model, stakeholder networks are developed based on one specific issue, event, or context to identify stakeholders and their relationships. This research breaks the limits of specific contexts by offering an integrative map displaying stakeholder interactions under multiple issues or events in a two-mode network. The results show multiplicity by identifying that to most of the SRIs, more than one stakeholder are associated as powerful parties, which means effective interactions among them are essential for implementing these SRIs. It also corroborates with stakeholder multiplicity proposed by Neville and Menguc (2006), that organizations' behaviors are the consequences of complex and conflicting interactions among stakeholders. As an example, in order to promote the disclosure of project information, stakeholders including end users, developers, contractors, governments, and district councils, should interact with each other to implement the issue. End users can gather to put forward their requirements for information disclosure. If developers or contractors do not respond appropriately, end users can seek an alliance with district councils and governments to exert influences on developers and contractors. Developers can also seek cooperation with contractors to respond to the external demands to disclose project information.

6. Conclusions

Pressured by international competitiveness, construction projects are demanded to be built in a socially responsible process that meets dynamic social and environmental requirements. Currently, research on SR in the construction industry is fragmented, and especially SR at project level lacks attention (Zeng et al., 2015). Instead of evaluating stakeholders' general influences, this research shed light on the dynamic stakeholder power on specific social issues, which are currently not addressed in general stakeholder theories due to the complexity of stakeholder environment. This research provides a systematic investigation on multiple stakeholders' power over a wide range of SRIs that frequently occur at construction project level. The research findings supplement research limits on individual stakeholder power, by showing the power differences among wider stakeholder groups including main contractors, developers, consultants, governments, district

councils, NGOs, and end users.

Several implications are identified from this research. Stakeholder-SRI relationship is developed for a better understanding of the distribution of stakeholder power on implementing the SRIs in construction projects. This research explains a dynamic stakeholder power structure from the perspective of the project lifecycle and SR dimensions. It illustrates the strengths and weaknesses of different project stakeholders regarding the SRIs and guides them how to allocate their scarce resources to achieve the SRIs. The findings help the stakeholders to put forward their demands in their dominant stage to gain sufficient responses. The results offer recommendations for project managers to engage with proper stakeholders to implement certain SRIs in construction projects.

This research has its limitations. It is important to note that the results can only show the general perceptions of stakeholder power, because, under different project delivery approaches, the distribution of stakeholders' power and responsibility varies significantly. For example, in a traditional design-build contract, contractors are mainly involved in the construction stage, while under an Engineering, Procurement, and Construction (EPC) contract, contractors participate early from the project planning stage. Different project types, either large-scale or small-scale, either public or private project, can also lead to changes in stakeholder power. In addition, because the respondents were part-time students from a construction management course at the university, most of who working in construction companies, it led to the under-representation of some affected groups, including district councils, NGOs, and end users. Coefficient of variance (CV) of the respondents' responses from different stakeholder groups was calculated, with the result of 0.38. It demonstrates that despite the unbalanced representation of stakeholder groups, the low-variant data shows respondents have similar perceptions on power hierarchies. The generalizability of the findings can be justified. The data was collected from Hong Kong practitioners; the results may be altered under different social, culture, and political environments in different countries. Nevertheless, the empirical findings about the dynamic power distribution of project stakeholders have its broad implications to future policymaking and project governance under various situations.

Extended from the research findings, future studies can focus on what strategies different stakeholders could use to exert their influence. Because the SRIs cannot be accomplished by a single stakeholder, how multiple stakeholders with diverse power and conflicting interests can collaborate to improve social performance is the important question to ask. From the research findings, multiple stakeholders were demonstrated with dynamic and distinctive powers and interests. Future research in project management should concern stakeholder multiplicity. Research perspectives should be drawn from different stakeholder groups, rather than from construction organizations as a general whole.

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Appendix: the sample of questionnaire of stakeholder power on the SRIs

In each blank in the matrix, the respondents need to fill in number indicating stakeholder's power to implement each SRI using the following scale.

5=extremely influential; 4=very influential; 3=moderately influential; 2=slightly influential; 1 = not at all influential;

	Social Responsibility Issues	Stakeholders						
		Main Contractor	Developer	End User	Government	Consultants	NGOs	District Council
Initiating and planning Stage	Disclosure of impacts							
	Stakeholder platform							
	Human right policies							
	Health and safety plans							
	Eco-friendly land use							
	Environmental feasibility							
	Environmental design							
	Transparent bidding procedures							
	Project codes of conducts							
	Customer participation							
	Relocation and compensation							
	Community development plan							
Execution Stage	Stakeholders regular meeting							
	Protections of migrant workers							
	H&S protections in construction							
	H&S culture promotion							
	Habitat protection							
	Waste control							
	Green procurement							
	Environmental management system							
	Anti-corruption in construction							
	In-door environment							
	Local suppliers							
	No disturbance on locals							
	Protection for locals							
Controlling and closing stage	Sustainability monitor and report							
	Anti-discrimination							
	H&S protections in demolition							
	Resettlement for employees							
	Green facilities training							
	Green culture							
	Non-polluting demolition							
	Transparent climate							
	User consulting							
	Rehabilitation							