https://doi.org/10.1016/j.ijproman.2016.12.009



# Addressing stakeholder complexity and major pitfalls in large cultural building projects

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Abstract

Many countries have put substantial investment into constructing large and iconic cultural buildings because they are the emblems of civic pride, as well as tools to generalize cultural and economic benefits. However, stories of project failures are often heard in this rapid cultural building boom. In fact, many pitfalls in developing large cultural building projects (CBPs) are associated to the stakeholders since they are the actual central figures of a project. As such, addressing stakeholder complexity and understanding major pitfalls in CBPs from stakeholder perspective are crucial to the successful management of these projects, yet relevant empirical studies remain lacking. To fill this gap, case study of a large performing arts center was conducted. A holistic stakeholder analysis approach, which applies both rationalistic methods (e.g. social network analysis) and empirical methods (e.g. survey and interviews), was adopted to address stakeholder complexity in the case. Three major pitfalls in large CBPs were identified, including ‘developing accurate end users' requirements’, ‘balancing between aesthetics, functionality and resources’, and ‘leadership team makeup, vision, charisma and learning stance’. Their underlying causes and possible solutions were discussed. This study contributes theoretically by illustrating a holistic approach of analyzing and addressing stakeholder complexity, and provides practical value by understanding the pitfalls of CBPs from stakeholder perspective.

Keywords: Cultural building project; Stakeholder; Social network analysis

## 1. Introduction

Large cultural building projects (CBPs) are the delivery of major cultural facilities constructed for accommodating artistic and civilizing activities of cultural organizations, as

well as cultural enjoyment of the public and community; they mainly include performing arts centers, theaters and museums (Woronkowicz et al., 2012). Pursuant to a study by the Cultural Policy Centre, a building boom of large CBPs was first seen in the United States since 1994 until 2008 — over US$16 billion were spent on the creation, expansion and renovation of cultural infrastructures during this period (Woronkowicz, 2012). Subsequent upsurges of CBPs appear in other parts of the world which have been undergoing unprecedented economic growth, e.g. the Middle East and China — in the single year of 2011, 390 museums were newly constructed in China (Cotter, 2013). This rapid cultural building boom is still expanding (Taylor, 2016), and the trend may be attributed to the evolving nature of CBPs; where they are now expectedtogeneratesubstantialsocialandeconomicbenefits, apart from merely maintaining the cultural vitality of a society. Many cultural infrastructures have been espoused by civic leaders as civic identity strategies to elevate the pride and international stature of a city; besides, they are often publicized as scenic spots to attract more visitors and new businesses (Woronkowicz et al., 2014). Notwithstanding the seemingly apparent benefits, stories of the hurdles and failures in CBP delivery have been recently reported, e.g. substantial project delays, significant cost overruns of nearly twice the budget (Agovino, 2014), poor stakeholder engagement (Pogrebin, 2012), stakeholder dissatisfaction with project outcomes (Woronkowicz et al., 2014); and in fact, many project problems are sourced from or related to the project stakeholders.

Every CBP development involves a wide range of stakeholders who have diverse backgrounds and interests, and are interdependent owing to intricate relationships and interactions. In fact, stakeholders are the central figures of a CBP as well as chief determinants

of its successful delivery (Lin, 2014), since cultural infrastructure developments are often 'human-driven' and 'human-oriented'. However, the high complexity of project stakeholders has been a hurdle in establishing stakeholder common ground and collaborations, leading to many challenges and pitfalls of CBP development which are actually emerged from or associated to stakeholders. As such, analyzing and addressing stakeholder complexity is a potential way to improve CBP management and outcomes.

In the context of CBPs, stakeholder complexity can be viewed from three aspects. The first aspect considers 'who the stakeholders are'. According to Project Management Institute (1996), stakeholders are any "individuals and organizations who are actively involved in the project, or whose interests may be positively or negatively affected as a result of project execution or successful project completion". It is important to identify as complete as possible all involved project stakeholders. However, 'hidden' stakeholders who have little apparent impacts or being remote from core project team are often discarded to the edge of stakeholder analysis process. The second aspect considers stakeholder relationships and influences. In CBPs, stakeholder groups are interdependent due to multiple formal and informal relationships across functional and organizational borders (Meese and McMahon, 2012). These relational structures are where the values, perceptions and behaviors of stakeholders emerge. As such, it is vital to analyze the interactions and impacts of stakeholders from network perspective. The third aspect considers stakeholder concerns, which refer to stakeholders' issues or vested interests in a project, which can be impacted favorably or unfavorably by the execution or completion of project (Li et al., 2012). Insufficiently accommodating the concerns of stakeholders can weaken their collaboration and result in resistive force. It is therefore crucial to completely identify the conflicting interests of stakeholders and decide which concerns to be addressed at higher priority. Although time, cost and quality have been conventionally regarded as the factors of

successful project delivery, the most critical determinants in a CBP are the human participants, that is, the stakeholders (Lin, 2014). Stakeholders' concerns, relational structures and influences should be fully analyzed to address stakeholder complexity of cultural projects (Yang, 2014); without which, the causes and potential solutions of major pitfalls in CBPs can hardly be identified from stakeholder perspective.

The rapid boom and failing stories of large CBPs indicate an urgent imperative to holistically address stakeholder complexity and to gain a comprehensive understanding on the major CBP pitfalls from the stakeholder perspective. However, stakeholder analysis research remains lacking in the field of CBP management. To bridge the gap, this study aims to address stakeholder complexity in large CBPs using a holistic approach. To achieve this aim, there are two research questions to be answered:

(1) Having said that a large CBP comprises numerous stakeholders, relationships, concerns, and project problems, how to holistically analyze them and systematically determine the critical ones (i.e. the important stakeholders, key concerns, and major project pitfalls)?

(2) What are the important stakeholders, key stakeholder concerns, and major project pitfalls in a large CBP development?

This study attempts to answer these questions by using a holistic stakeholder analysis approach which combines both analytical perspectives of empiricism and rationalism (Markie, 2013; Yang, 2014). In this approach, social network analysis (SNA) (a rationalistic method) is adopted to identify, analyze and prioritize stakeholders and stakeholder concerns in the project; while interview (an empirical method) was used to identify and facilitate a thorough understanding on the major CBP pitfalls from the stakeholder perspective. Case

study of a large performing arts center was undertaken to illustrate the complete stakeholder analysis process as wellas to address the stakeholder complexityin the project. Albeit that the case study findings might not be generalized across the industry due to limited context, this study reveals possible reasons behind the failing stories of large CBP development and suggests recommendations.

This paper begins by discussing the definition, perspectives and current methods of stakeholder analysis, with an emphasis on SNA through an overview of the social network theory and its applications in construction project management. The research methodology section provides detailed explanations on the case study approach; the procedures to collect, analyze and corroborate social network data; and the processes of prioritizing concerns and understanding project pitfalls. The next section presents the SNA results of a case study, which is a large performing arts center for Chinese opera. Subsequently, the findings on major CBP pitfalls, their underlying reasons and possible solutions obtained from interviews are discussed in-depth; followed by a conclusion.

## 2. Literature review

### 2.1. Stakeholder analysis — conception and methods

Stakeholder analysis refers to the processes or approaches to address stakeholder complexity in a project environment. A growing research interest on this topic has been seen since the 1990s, where many scholars attempt to define and propose practical methods for stakeholder analysis. Gupta (1995) defined it as a systematic means to identify ‘who can make an influence’, depict the interrelationships of these parties, and specify their concerns. Similarly, Yang et al. (2011) regarded it as an indispensable part of stakeholder management

that identifies stakeholders and their interests, evaluates stakeholders' interactions and measures their influences. In fact, many previous studies are in common by stating stakeholder and interest identification, relationship assessment and impact evaluation as the major steps of stakeholder analysis (Mushove and Coleen, 2005; Reed, 2008; Varvasovazky and Brugha, 2000; Weible, 2006). Besides, many studies asserted that stakeholder analysis facilitates decision making and strategy development (Jepsen and Eskerod, 2008; Olander, 2007; Reed, 2008; Schmeer, 1999); e.g. according to the World Health Organization (2016), stakeholder analysis "provides an essential understanding for analysing and selecting response options anddeveloping strategies" toovercomehurdlesin project implementation. As Badertscher (2015) stated, it is challenging for cultural builders to identify stakeholders and "filter the key issues from all the noise", stakeholder analysis is thus a vital process for them to understand and address the stakeholder complexity.

This study considers stakeholder analysis in large CBPs as a process of three major steps: (1) stakeholder identification — to list out all stakeholder groups, their concerns in the project, and the meaningful relationships between them; (2) stakeholder assessment — to analyze the relational structures of stakeholders, measure stakeholder impact and concerns' importance in the project; and (3) stakeholder prioritization — to decide which stakeholders are influential and who are under-engaged, and determine which concerns should be handled with higher priority.

Previous studies developed various stakeholder analysis methods and Yang (2014) proposed two analytical perspectives to classify these approaches. The first perspective is empiricism, in which one's knowledge of stakeholders is and can only be acquired based on the experiences of one or some core stakeholder (Markie, 2013). Many conventional methods, such as Mitchell et al.'s (1997) stakeholder salience model, Bourne's (2005)

Stakeholder Circle methodology, Olander's (2007) stakeholder impact index, and Newcombe's (2003) power/ interest matrix, adopt empiricism. This perspective has the advantages of relatively quick and straightforward decision making, yet it receives criticisms for being unable to tackle the cognitive limitations of focal stakeholders when the project grows in size and complexity, e.g. difficulties in marking a complete boundary of stakeholders and depicting their reciprocally influential nature (Crane and Livesey, 2003; Yang, 2014). In the second perspective, rationalism, one's knowledge is stand-alone from the perceptions and experiences of core stakeholders (Markie, 2013); and the knowledge is acquired by thoroughly engaging all stakeholders and understanding their actual interactions (Yang, 2014). Chain referral sampling and SNA adopt rationalism (Biernacki and Waldorf, 1981; Rowley, 1997). This perspective is relatively rational and objective, despite requiring a longer time and greater effort in data collection. This study adopts a combination of empiricism and rationalism by applying SNA in conjunction with survey and interviews, so as to complement the different results and address stakeholder complexity from a full angle.

## 2.2. SNA

Emerging from the social network theory, SNA is an instrumental tool to visualize interactions between individuals and analyze the social aggregates by integrating mathematical, computational and statistical techniques (Solis et al., 2013). As Mitchell (1969) conceptualized, social network is a set of linkages connecting a definite set of individuals; where the roles and social behaviors of a person are readily influenced by its connected neighbors in the network.

Wasserman and Faust (1994) also added that the way that these persons connect can affect the robustness and performance of the whole network system. Since every “construction project

is a combination of social interaction and project collaboration" (Chinowsky et al., 2008), the stakeholders of a CBP are interdependent in the form of social network. As such, using SNA to analyze the interactions between CBP stakeholders can help to interpret their behaviors, assess their influences, and identify opportunities for improving stakeholder collaboration and overall project performance.

Classical network studies appeared in sociometry in the 1960s (Moreno, 1960), since then, network theorems have gained attention from many fields including construction management. Pryke's study (2004) has been regarded groundbreaking as it explored the feasibility of SNA in interpreting construction project coalitions, and proposed a network perspective to understand relationships between project participants. Another pioneering study is the work of Chinowsky et al. (2008), where they recognized the importance of project network and developed a social network model to improve knowledge sharing, as the bedrock of achieving effective team and project performance. In recent years, network studies extend to cover more different aspects of the engineering and construction field. For instance, Williams et al. (2015) studied the network structures of online stakeholder discussions in a mega project and interpreted their implications on stakeholder engagement and project execution. Almahmoud and Doloi (2015) developed a SNA-based model to assess social sustainability outcomes in construction projects by mapping stakeholder relationships. Yang et al. (2016) examined the critical 'green' risks in Australia and China, by modeling and comparing their stakeholder-related 'green' risk networks with SNA. Similarly, Li et al. (2016) identified the key schedule risks in prefabrication housing production by analyzing their networks in supply chain. Notwithstanding a growing recognition of SNA in the construction field, it has gained limited attention from cultural builders and researchers.

In the construction project management research, communication, information exchange and knowledge exchange are three common kinds of relationships to be studied (Pryke, 2004; Chinowsky et al., 2008). This study focuses on information exchange between stakeholders, because in the social context, project stakeholders are engaged and managed through efficient information flows (Lin, 2014). Understanding their information flows could therefore help to explain how the stakeholders are engaged and who sits in the hub of communication. This paper does not study communication relationships because they can include informal and personal communications of stakeholders which are not within our scope. As Chinowsky et al. (2008) stated, every project activity "requires a transfer of information", the mathematical and analytical abilities of SNA would allow project team to measure the effectiveness of stakeholder interactions and identify areas for improvement. In this study, information exchange between stakeholders refers to their provision or receipt of information which necessitates the implementation of required tasks and fulfillment of individual goals/stakes (Chinowsky et al., 2008). Analyzing social interactions of stakeholders with SNA comprises five main steps (Wasserman and Faust, 1994), they are: (1) identifying the stakeholders, (2) mapping their relationships, (3) visualizing the networks, (4) mathematically examining the network structures, and (5) interpreting the analysis results. The methodology section will give detailed explanation on the SNA process, network metrics, their theoretical definitions and practical meanings for stakeholder information exchange network.

## 3. Research methodology and process

### 3.1. Case study method

Case study is an in-depth investigation of the process and outcomes of a contemporary real-life phenomenon (Tellis, 1997). This approach is considered applicable when: (1) the phenomenon contains various relationships/factors whose interactions are the research focus (Fidel, 1984); (2) the research focus concerns 'why' and 'how' questions (Yin, 2009); (3) the examination of phenomenon becomes meaningless without its embedded context (Baxter and Jack, 2008); and (4) context-dependent knowledge can only be generated with the minimum intervention of the investigator (Yin, 2009). This methodology is adopted herein since the research setting fits the above considerations. There are different kinds of case study including descriptive, evaluative and interpretative (Merriam, 1988); intrinsic, instrumental and collective (Stake, 1995); single- and multiple-case (de Vaus, 2001). A single, instrumental and interpretative case study is undertaken since the research intends to gain comprehensive and in-depth understanding of a unique project setting, and the findings are expected to bring insights for other CBPs of similar contexts.

Case selection is a rigorous process as "case study is not a methodological choice but a choice of what to be studied" (Stake, 2005). Information-oriented sampling is adopted herein for case selection (Flyvbjerg, 2006). The chosen case should fulfill four criteria. First, it should involve a wide range of stakeholders with complex relationships and diverse interests as these are the sources of complexities in project stakeholder management. Secondly, major CBPs are considered as they usually involve many stakeholders. Thirdly, the authors consider ongoing CBPs instead of completed projects; because in ongoing projects, comprehensive information could be collected, while in past projects, there is often information missed. Lastly, the authors prefer cases of performing arts center (PAC) among various kinds of CBPs. According to Woronkowicz et al. (2014), PACs are the largest and most costly type of CBPs in comparison

with museums and theaters. The project nature of PACs is also complex since they often incorporate multifunctional facilities such as theaters, concert halls, user amenities and public spaces. The selected case meets these criteria and its background is described in the next section. To understand the project background, document review was conducted on the below: project profile, public engagement reports and development plan prepared by the client; project brief by design consultants; environmental impact assessment report by consultancies; relevant articles by local Chinese opera organizations; relevant discussion papers by legislative council, etc. The information was analyzed under four themes: project background; stakeholders; stakeholder concerns; and information flow of stakeholders.

Since stakeholder relationships and concerns evolve with time, a definite time span should be determined (Baxter and Jack, 2008; Stake, 1995). When the authors entered the selected case, the construction stage of the case project had commenced for a few months. The stakeholder network herein captures relational structures at a point-in-time in the construction phase. In addition, all stakeholders that were interviewed and surveyed in this study have full knowledge about the concerns and problems throughout the project from its beginning to the construction stage. To ensure the reliability of collected data and the objectiveness of case analysis, the authors maintained a neutral relationship with the core project team and stakeholders — the authors played an impartial role and did not favor any sides in the entire study. In addition, the authors maintained independent from the situation under exploration, so as to ensure a minimum intervention from the investigators to the research context. The outcomes of literature review and document analysis help the authors to assemble two tentative lists of stakeholders and concerns of the case. These two lists would serve as reference to assist the later stages of stakeholder and concern identification.

3.2. The case project

The case project is an US$348 million arts venue particularly constructed for the performance, production, education and research of Chinese opera in a metropolitan city K. This building has seven storeys and two underground basement levels, with a footprint of 13,800 $m^2$ on site. The project scope comprises four main parts: (1) two auditorium for 1100 and 400 seats, (2) a 280 seat tea house theater for traditional recitals and Chinese tea tasting, (3) training and educational facilities (such as rehearsal rooms and studios) of 2000 $m^2$, and (4) an atrium for public leisure. The unique nature and high complexities of this project necessitate a relational approach for stakeholder analysis and concern prioritization. For instance, there are rare local and overseas examples of art venues specially built for Chinese opera, the project team lacks 'role models/benchmarks' for reference in the design and delivery process. There are over 200 genres of Chinese opera while each of which has unique requirements on stage, instruments and costumes; presenting a great diversity in end users' requirements. This venue is lantern-shaped with the 1800 tonne main theater structure (made of structural steel) situated at the building top; requiring the use of heavy lifting method whose operation is technically complex. The construction is adjacent to an established shopping district whose congested traffic has added difficulties to the site vehicular access. The budget and schedule are both tight, any cost and time overruns may result in huge controversies as the project is of high profile.

The research process in this study includes four main parts: (1) conducting SNA to analyze the information exchange relationships of stakeholders, (2) assessing the centrality index and influence level of each stakeholder, (3) prioritizing stakeholder concerns in the project, and

(4) conducting interviews to identify major CBP pitfalls based on the SNA results and gain a thorough understanding on the identified pitfalls.

### 3.3. The stakeholder analysis process

This study applies a combination of empirical and rationalistic stakeholder analysis methods to analyze stakeholder complexity. First, SNA (a rationalistic method) was used to identify, assess and prioritize project stakeholders and stakeholder concerns. Then, interviews (an empirical method) were conducted to identify major project pitfalls based on the SNA results, as well as to understand the possible causes and potential ways of alleviating the problems. Using a single analytical perspective (either empiricism or rationalism) to analyze stakeholder complexity may not be able to obtain a complete picture. The actual problems encountered by stakeholders cannot be fully comprehended if solely relying on the SNA results while without communicating the results to the stakeholders. In contrast, conducting only interviews is not a rigorous approach to analyze stakeholder complexity — as stakeholders may mention many project problems in the process; if solely synthesizing the interview findings, it would be rather subjective to determine which problems as 'key' that should be addressed at higher priority. Using both analytical perspectives brings the benefits of complementing the quantitative stakeholder assessment results with the qualitative information from stakeholders to completely interpret the stakeholder environment, to thoroughly understand the actual problems faced by stakeholders, as well as to come up with practical recommendations for alleviating the problems. Fig. 1 illustrates this complete stakeholder analysis process and the following sub-sections explain the details.

#### 3.3.1. Conducting SNA

Identification of stakeholders, i.e. the nodes, is the first step of social network data collection. Chain referral sampling is used (Biernacki and Waldorf, 1981), which involves three stages: (1) core project team members are asked to appoint internal stakeholders, (2) these referred parties will then name the external stakeholders, and (3) lastly the newly nominated groups will refer any additional stakeholders, who may influence or be influenced by the project, but are still missing in the chain. Four representatives from the client, main contractor and lead design consultant were reached to start the chain, and they all have full responsibilities in project development. To facilitate the identification process, all participants were given a reference list of stakeholders; this list had been previously created via document analysis and literature review, with feedbacks obtained from the core project team. When stakeholders were nominated, the researchers would approach them to confirm/clarify their role, responsibility and involvement in the project; and to gain their consent to participate in the subsequent survey. Eventually, 18 stakeholders were identified and coded numerically from S1 to S18, as shown in Table 1. This stakeholder list and the brief description had been sent back to the core project team for feedbacks and were subsequently confirmed after minor amendments.

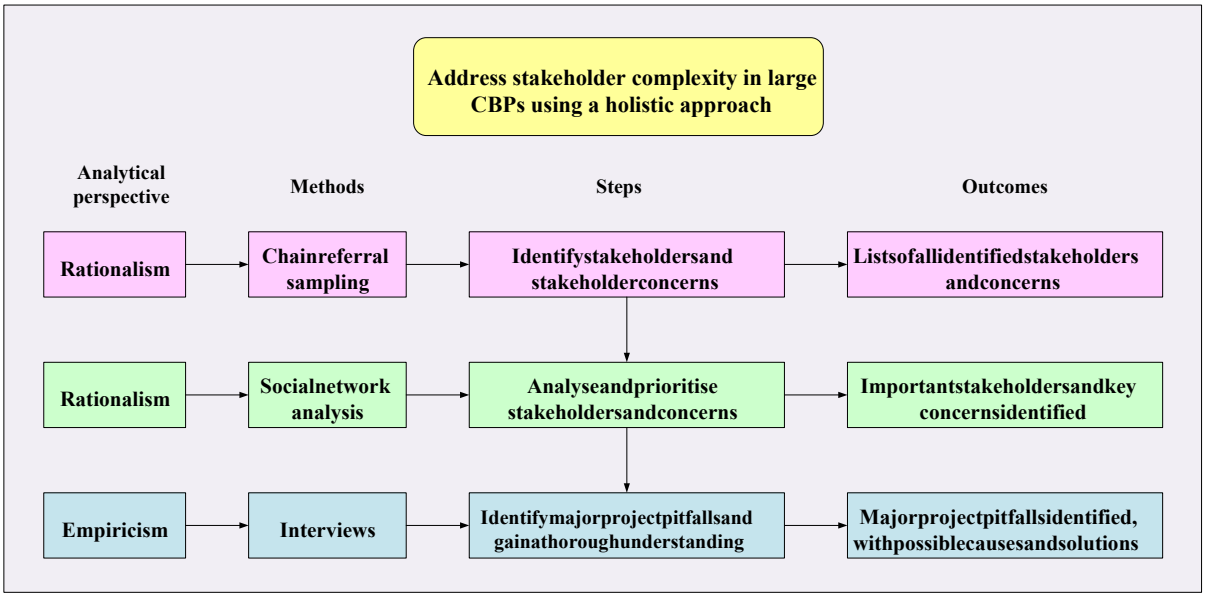


Fig. 1. The stakeholder analysis process in this study.

Identification of stakeholder concerns was the second step. It was conducted by a combination of document analysis, literature review and interviews. Initially, project documents (such as the project profile, public engagement reports, the government's discussion papers) and relevant literature (about ‘stakeholders’ and ‘cultural facility projects’) were reviewed and analyzed, a reference list of stakeholder concerns was developed. Subsequently, interviews were conducted with key project participants from the initially approached stakeholders, to have deeper understanding on the concerns and to gain feedbacks on the concern list. The concern list was further revised according to the core project team's feedbacks and was confirmed with all stakeholder representatives. Finally, 54 concerns were identified. This list will form a part of the questionnaire survey, and assist the link identification and concern prioritization tasks in the later stage.

Identifying and assessing stakeholder information exchange relationships were the third step. Prior to this task, it is important to define the scope of ‘information’ and ‘means of information exchange’. For the purpose of this study, information refers to: (1) any information relating to

the 54 identified stakeholder concerns, and (2) any information whose transmission can help or is essential for the stakeholders to understand or address these concerns. The means of information exchange include face-to-face meetings, tele-/ video-conferences, phone calls, emails, letters, memos and discussions on e-platform, etc. The reason for considering a variety of means is that they have been widely used by all identified stakeholders in the project. A questionnaire survey was conducted with representatives of the 18 stakeholders, who had taken part in stakeholder and concern identification, for determining and evaluating the links. All respondents (except S17 and S18) were at senior management level, with over 10 years work experience in their field, and fully responsible in the project. A sample questionnaire (which also presents the list of 54 stakeholder concerns) can be found in the following hyperlink: https://drive.google.com/file/d/

Table 1

| Stakeholder | | Description |
|---|---|---|
| S1 | Client project delivery division | A division in the client organization who oversees the overall planning, construction and management of the case project |
| S2 | Client performing arts division | A division in the client organization who engages the end users (e.g. opera performers, operators, specialists and advisors of different art forms), consolidate end users' requirements and develop the design brief |

| | | |
|---|---|---|
| S3 | Lead design consultant | A consultancy firm to undertake architectural design and contract administration; it won the design competition launched by the client for the case project and is subsequently appointed as lead design consultant |
| S4 | Main contractor | A contractor company to construct the performing arts venue and manage the project programme |
| S5 | Quantity surveying consultant | A consultancy firm appointed by the client to provide cost management and advisory services |
| S6 | Structural engineer | A consultancy firm appointed by the client to provide façade and structural engineering design and solutions |
| S7 | MEP design engineer | A consultancy firm appointed by the client to provide MEP design and engineering solutions including sustainability, security, specialist lighting, audio visual, etc. |
| S8 | Theater design consultant | A consultancy firm appointed by the client to undertake theater planning and design |
| S9 | Fit-out subcontractor for timber works | A subcontractor company jointly selected by S1 and S4 to carry out fit-out works (timber works) |
| S10 | Fit-out subcontractor for metalwork | A subcontractor company jointly selected by S1 and S4 to carry out fit-out works (metal works) |

| | | |
|---|---|---|
| S11 | Structural steel subcontractor | A subcontractor company employed by S4 to undertake structural steel works |
| S12 | Electrical subcontractor | A subcontractor company employed by S4 to carry out electrical installation works |
| S13 | Theater system subcontractor | A subcontractor company employed by S4 to supply and install theater system |
| S14 | MVAC subcontractor | A subcontractor company employed by S4 to supply and install MVAC system |
| S15 | Fire services and plumbing subcontractor | A subcontractor company employed by S4 to supply and install fire services and plumbing & drainage works |
| S16 | ELV subcontractor | A subcontractor company employed by S4 to supply and install ELV system |
| S17 | District council | A consultative body (supervised by the government) who gathers opinions from the public and local community concerning the development, and reflects their views to the client |
| S18 | End users | Performing arts organizations who are potential end users of the facilities in the performing arts venue |

Profile of stakeholders identified in the case study.

0B0QPYm5hWbDzTUd5blFzbmlVVDQ/view?usp=drivesdk. In the survey, respondents were asked to identify their information providers and recipients among the 18 stakeholders in the case project. After identifying the links, respondents were asked to assess each link based on three relationship attributes using five linguistic-based levels: (1) frequency,

referring to the frequency of information transmission (‘1’: fewer than once a month, ‘2’: biweekly to monthly, ‘3’: weekly, ‘4’: several times a week, and ‘5’: at least once per day), (2) access, referring to the level of timeliness in which information is obtained from/provided to stakeholders (with ‘1’ meaning the lowest and ‘5’ meaning the highest), and (3) information quality, referring to the quality of information in terms of correctness, completeness and comprehensibility (with ‘1’ meaning the poorest and ‘5’ meaning the best quality). ‘Frequency’ and ‘information quality’ are two relationship attributes widely used in SNA studies (Lin, 2014; Meese and McMahon, 2012; Solis et al., 2013), while ‘access’ is also an important factor to differentiate between effective and ineffective relationships (Cross et al., 2001). The survey data collection lasted for about two months, and the questionnaire design included a piloting cycle to minimize ambiguities and errors in the instrument. A confidentiality statement was included in the survey to alleviate respondents' concerns on ethical issues and anonymity of the data. After collecting all relational data via the survey, a sanity check was conducted to identify any mismatches in the data, e.g. S1 declares to give information to S2, but S2 does not identify S1 as an information provider. In such occasion, the researchers would look into and resolve

Table 2

SNA metrics, their theoretical definitions and practical interpretations for stakeholder information exchange network.

(a) Network level metrics

| Metrics | Theoretical definition | Practical interpretation | Implication for overall network structure |
|---|---|---|---|
| Density | The ratio of actual ties in a network to the greatest number of possible ties when all nodes are interconnected. | The overall network connectivity. | A higher density value represents a higher occurrence of information exchange in the whole project. |
| Cohesion | The number of ties, or the length of path, to reach nodes in a network. | The time taken for information to be diffused in the network. | A lower cohesion value benefits information flow, as it represents a shorter time or path for information to be disseminated among stakeholders. |
| Centralization | A measure of variability of the nodes' centrality scores and it ranges from 0 to 1. The extent to which specific gains the greatest value of 1 if a node interacts with all | Centralization equals to 0 if all nodes have the same centrality scores. It stakeholders control the flow of | In a highly centralized network, information flow is controlled by one or a few stakeholders. A decentralized network is more favorable for long term information/knowledge sharing as |

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| | other nodes, and they are tied to this information in the network. | | | the majority of ties are no longer hold by a few stakeholders. |

(b) Node level metrics

| Metrics | Theoretical definition | Practical explanation | | Implication for central stakeholders |
|---|---|---|---|---|
| | | | Role | Description |
| In-degree centrality | The number of direct incoming ties transmitted to a specific node. | The degree to which a stakeholder receives information from its direct neighbors in the network. | Information recipient | A stakeholder with high in-degree has high accessibility to information in the project. |
| Out-degree centrality | The number of direct outgoing ties emitted by a particular node. | The degree to which a stakeholder provides information to its direct neighbors in the network. | Information transmitter | A stakeholder with high out-degree is influential as it can quickly disseminate one's information to a large population. |
| Degree difference | The difference between out-degree and in-degree scores of a specific node. | Degree difference is calculated by deducting the out-degree from in-degree of a | Peripheral actor | A stakeholder with larger in-degree than out-degree is considered peripheral, i.e. less |

| | | | |
|---|---|---|---|
| | | stakeholder to identify peripheral actors. | influential, in the project as it is an information receiver more than provider. |
| Power centrality | The degree of which a node's immediate neighbors are dependent on this node. In degree measure, a node's centrality is determined by the number of its direct ties/ neighbors. In power measure, a node's centrality is a function of the centrality scores of its immediate neighbors. | The extent to which a stakeholder is being relied on by its connected others for information access. | Powerful stakeholder | A stakeholder is powerful (i.e. with high power centrality score) if its interacting others are not themselves well connected. In contrast, if the interacting others are already well connected to other stakeholders, they would be less dependent on this stakeholder for information access, thus this stakeholder is less powerful. |

| | | | | |
|---|---|---|---|---|
| Betweenness centrality | The incidence in which a specific node falls on the geodesic distance between other pairs of nodes. | The extent to which a stakeholder acts the role of broker/gatekeeper in the communication between other stakeholders by controlling or filtering the information flow between them. | Information broker | This role facilitates communication by diffusing information to stakeholders which may otherwisebe disintegrated from the network. This role may also interfere with communication if it transmits information in a poor quality or untimely manner. |
| Closeness centrality | The distance, or the number of intermediaries, of a particular node to every other nodes in the network on the basis of shortest path. | An indication of how the entire network is proximate to or rivet on a stakeholder. It also reflects a stakeholder's independence in the | Focal actor | This role enjoys a higher quality of communication (e.g. lower chance of information distortion, and shorter information transmission time) due to their shorter distance with other |

| | | |
|---|---|---|
| | relational activities in the network. | stakeholders. However, it is difficult for this stakeholder to act alone without drawing others' attention. |

the mismatch by seeking viewpoints from relevant stakeholders on the contradicting stories, and inquiring (via face-to-face meetings or on phone) their particular information exchange habits and interactions from different angles; in an attempt to achieve consensus about the specific information exchange relationships. Workshop with the core project team and all stakeholder representatives is also an effective means to sort out data mismatches. Finally, 129 links connecting 18 stakeholders were defined. The information exchange frequency provides the basis of creating adjacency matrix. Accordingly, the matrix representing the stakeholder information exchange network G (18,129) was developed.

After building the social network, NetMiner was applied for network visualization due to its high capability in exploratory network analysis (Furht, 2010). There were three stages in the network analysis process. Firstly, the network was differentiated into three sociograms based on relationship attributes, then the sociograms were visually inspected and compared to gain initial insights regarding the effectiveness of stakeholders' information exchange in the project. In the second stage, three network-level metrics, namely density, cohesion and centralization, were computed to analyze the overall network structure quantitatively. In the third stage, six node-level metrics, namely in-degree, out-degree, degree difference, power, betweenness, and closeness centrality, were calculated to understand the positions and roles (e.g. information broker, central connector, peripheral actor) of individual stakeholders, and spot opportunities for improving stakeholder information exchange. Table 2 explains the theoretical definitions of these SNA metrics, and their practical interpretations for the stakeholder information exchange network.

3.3.2. Assessing stakeholders' influences

This process was to assess stakeholders' influence levels in the project based on the node level results, and it included three steps. Calculating the centrality index of each stakeholder was the first step. The degree, betweenness and closeness centrality values were normalized to avoid the effect of network size, and thus ranged between 0 and 1 (Beauchamp, 1965). Then, the three centrality scores of each stakeholder were averaged to obtain its centrality index (Dogan et al., 2013). The second step was to prioritize stakeholders according to their centrality index, and obtain their ranking. The last step was to evaluate stakeholder influence in the project. The influence level of each stakeholder can be calculated by Eq. (1):

$$\text{SInf}_u = \frac{R_{max} + 1 - \text{rank}(u)}{\sum_{v=1}^{n} R_{max} + 1 - \text{rank}(v)} \quad (1)$$

where $\text{SInf}_u$ denotes the influence level of stakeholder u in the project; $R_{max}$ is the highest rank among all stakeholders; rank(u) is the fractional rank of stakeholder u, and n is the total number of stakeholders in the project (Lim and Finkelstein, 2012) A lower rank implies a greater stakeholder influence, therefore this expression deducts a stakeholder's rank from the upper limit of $R_{max}$ + 1, to invert the rank value (Lim and Finkelstein, 2012).This is then divided by the sum of all stakeholders' influence levels for normalization, so as to reflect the actual impact of a stakeholder among all 18 stakeholders.

3.3.3. Prioritizing concerns

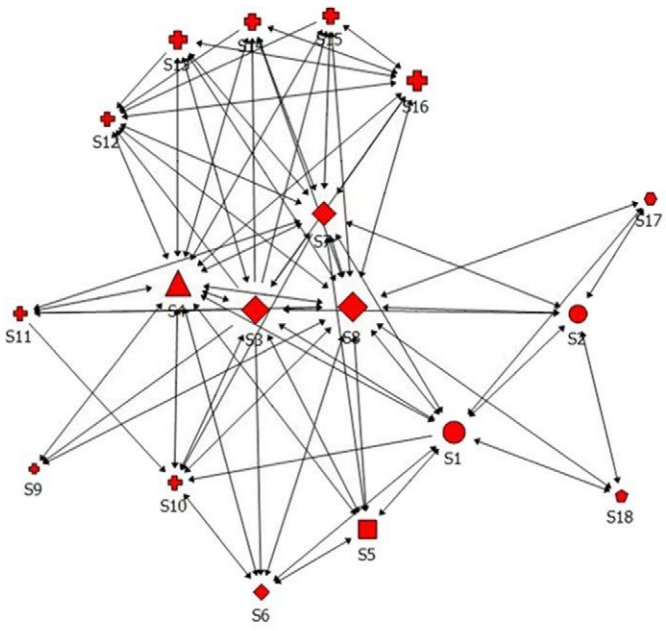
This process aims to prioritize stakeholder concerns in the project. First, the importance level of each of the 54 concerns in the project was evaluated using Eq. (2):

$$IImp_A \text{¼} \sum_{j}^{n} {}_1 SInf_{\text{¼}} \quad j \; r_{Aj} \eth 2 Þ$$

where $IImp_A$ represents the importance level of a stakeholder concern A in the project; $SInf_j$ is the influence level of stakeholder j; $r_{Aj}$ is the rating given by stakeholder j on the concern A; and n is the total number of stakeholders (Lim and Finkelstein, 2012). Stakeholders' ratings on a concern, $r_{Aj}$, were obtained through the aforementioned survey, where representatives of the 18 stakeholders had been required to rate the importance of each concern based on their empirical knowledge using a five-point scale (with '1' and '5' meaning the least and the highest respectively, and 'N/A' meaning the concern being unrelated to the stakeholder). This calculation considers both stakeholders' perception on a concern's importance in the project, and the actual influence of each stakeholder in the real relationship situation. Next, the 54 concerns were prioritized based on their importance level. The output was a ranked list of concerns, with those of greater importance ranked higher. Basically, the top concerns represent those which are perceived as the most critical and are most frequently communicated by stakeholders in the project. The project team should pay particular attention in handling them.

### 3.3.4. Identifying and understanding the major project pitfalls

This process aims to triangulate the SNA results, identify the major pitfalls in CBPs based on the SNA results, and understand the possible causes and solutions of these project pitfalls. Interviews with the core project team and stakeholder representatives was the primary means.

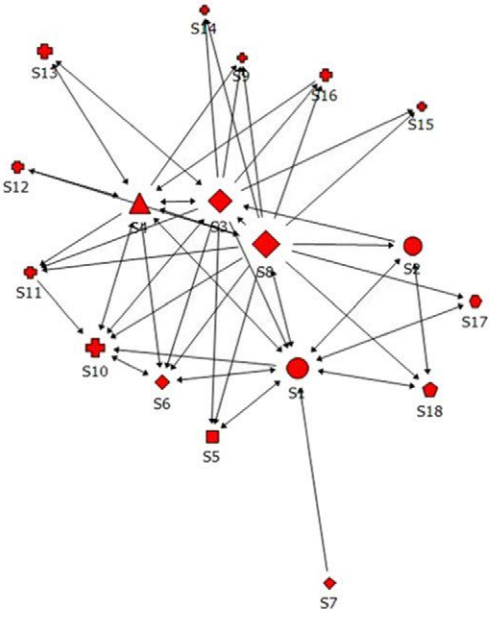



**Legend**

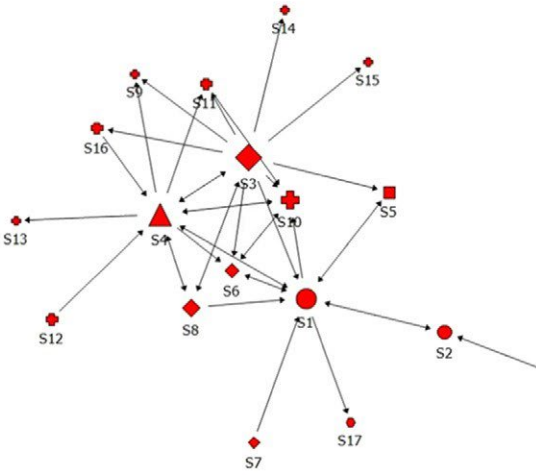
- Client
- Contractor
- Cost Consultant
- Designer
- End User
- Government agency
- Subcontractor

| Properties | Network A | Network B | Ne |
|---|---|---|---|
| No. of links | 129 | 61 | |
| Network density | 0.422 | 0.199 | |
| Network cohesion | 1.578 | 2.066 | |
| In-degree centralization | 0.613 | 0.350 | |
| Out-degree centralization | 0.613 | 0.723 | |

(a) Original information exchange network G




(b) The network G'




(c) The network G''

Fig. 2. Information exchange network(s) in the case project. Note: (1) Links of ‘poor/fair quality’ refers to the connections which score ‘3’ or less in the relationship attribute ‘Information quality’. (2) Links of ‘poor/fair timeliness in access’ refers to the connections which score ‘3’ or less in the relationship attribute ‘access’.

After the SNA and concern prioritization, all stakeholder representatives weregiven the results and wereinterviewed. First, they were asked to provide feedbacks on these quantitative assessment results. In general, all stakeholders agreed with the SNA results and the ranked concern list; they also opined that the figures and results were easy to comprehend. Next, all stakeholder representatives were invited to express, based on the SNA and concern prioritizationresults,their opinionson three main questions: (1) Why and how are the identified key concerns important in the case project? (2) Do these important concerns reflect any major/common pitfalls in large CBP development? What are these pitfalls? (3) What are the causes of pitfalls and the possible solutions to alleviate these problems? All interviews were recorded and transcribed. Manuscripts were sent to the interviewees for feedbacks and minor amendments were made according to interviewees' suggestions. Based on the confirmed manuscripts, the collected information regarding the three aforementioned questions were analyzed and consolidated under four main themes: (1) why/how the identified key concerns are critical; (2) which major pitfalls in CBPs (as reflected by or relating to which identified key concerns); (3) causes of pitfalls; and (4) recommendations/solutions. At last, the consolidated results were returned to the core project team for feedbacks. After several rounds of comments from the core project team (via phone, face-to-face meeting, and written) and minor amendments back-and-forth, the interview findings were finalized and confirmed.

## 4. The SNA results

This section discusses the numerical findings in three parts: (1) structure and properties of the stakeholder information exchange network based on network measure results; (2) stakeholder roles and priorities based on node measure results; and (3) concern prioritization based on their weighted importance.

### 4.1. Stakeholder information exchange network

Sociograms of the stakeholder network, in terms of information exchange frequency, are shown in Fig. 2. Nodes denote the stakeholders, while lines represent the existence of interactions between stakeholders. Stakeholders with more interactions occupy a more central position, while those with fewer ties are located more peripheral. The network is differentiated into three sociograms based on relationship attributes. Fig. 2(a) shows the original network G(18, 129), comprising 18 stakeholders linked by 129 interactions. Removing poor/fair quality links (i.e. those scoring '≤3' in the attribute 'information quality') yields the network G′(18, 61), as shown in Fig. 2(b). Further eliminating links of poor/fair information access timeliness (i.e. those scoring '≤3' in the attribute 'access') from Fig. 2(b) forms the network G″(18, 41), as seen in Fig. 2(c). G″ shows the interaction pattern when information of good quality is transmitted in a timely manner. Observing variations of the three sociograms in terms of network structure and central nodes yields interesting findings. First, stakeholders are more interconnected in G than in G″. The original network has a high connectedness since stakeholders in all node pairs can mutually reach each other. In contrast, G″ has more one-way interactions and cut points. Cut points refer to nodes who connect the otherwise isolated actors through weak ties (Meese and McMahon, 2012). This observation indicates that the relational structure of stakeholders is vulnerable to disruption when timeliness and quality are taken into

consideration. Although weak ties are not favorable for transmitting complex information, they should be protected from attacks to maintain stakeholder communication. Second, S3 (lead design consultant), S4 (main contractor), S7 (MEP design engineer) and S8 (theater design consultant) occupy central positions in G. However, S7 and S8 are peripheral in G″, reflecting a need for these two stakeholders to improve their quality and timeliness as they interact frequently with others.

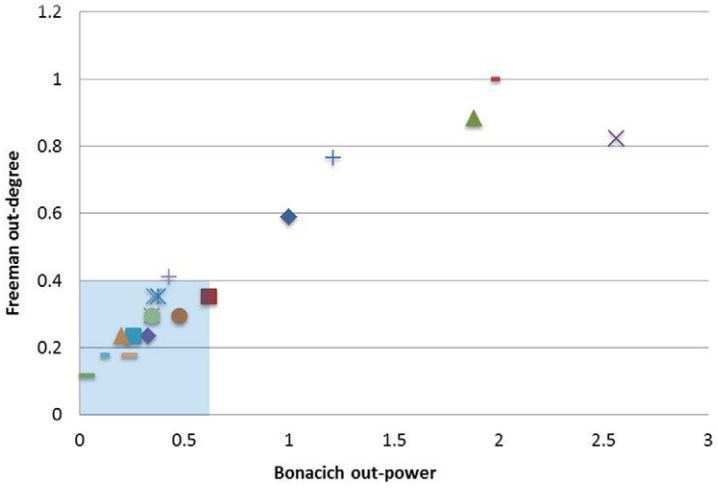
Three network metrics (density, cohesion and degree centralization) are calculated to analyze the network structure quantitatively, as also shown in Fig. 2. Density measures the network connectivity, where the higher density represents the higher incidence of information exchange. Cohesion indicates the time taken for information to be diffused in the network (Yang, 2014). A lower cohesion favors information flow as it implies a quicker dissemination. According to Cross and Parker (2004), a cohesion value of 2 is regarded reasonable for information network. The density and cohesion values of G, G′ and G″ are (0.422, 1.578), (0.199, 2.066) and (0.134, 2.335) respectively. The sharp decrease of density implies that many interactions in the original network are rated poor/fair regarding information quality; indicating a need for stakeholders to improve the correctness, completeness and comprehensibility of information. Cohesions in all three structures are less than 2.5, which are considered acceptable. In-degree centralization measures the extent that particular stakeholders control the incoming links of information flow. In-degree centralization of G and G″ are 0.613 and 0.294 respectively. This sharp drop implies that only a few specific stakeholders can enjoy a timely access of good-quality information.

### 4.2. Stakeholder roles and priorities

Six node metrics (in-degree, out-degree, degree difference, power, betweenness, and closeness centrality) are calculated to analyze stakeholder roles in information exchange and

assess their impacts. It should be noted that the calculation builds upon the original network G, as this study intends to decipher stakeholder relational structure based on their actual interaction patterns.

Fig. 3 plots the out-power against out-degree centrality of stakeholders. Power and degree are two distinct centralities to measure an actor's power and influence respectively. Outpower indicates the extent that a stakeholder is being relied on by its connected others for information access. The higher the out-power, the more powerful a stakeholder is since its neighbors are not well connected and thus become dependent




Legend

S1 S2 S3 S4 S5 S6 S7 S8 S9
S10 S11 S12 S13 S14 S15 S16 S17 S18

| | Out-Power Centrality | Out-Degree Centrality |
|---|---|---|
| S1 | 0.9971 | 0.5882 |
| S2 | 0.6147 | 0.3529 |
| S3 | 1.8840 | 0.8824 |
| S4 | 2.5604 | 0.8235 |
| S5 | 0.3745 | 0.3529 |
| S6 | 0.4746 | 0.2941 |
| S7 | 1.2109 | 0.7647 |
| S8 | 1.9665 | 1.0000 |
| S9 | 0.0335 | 0.1176 |
| S10 | 0.3253 | 0.2353 |
| S11 | 0.2540 | 0.2353 |
| S12 | 0.2016 | 0.2353 |
| S13 | 0.3546 | 0.3529 |
| S14 | 0.3432 | 0.2941 |
| S15 | 0.3432 | 0.2941 |
| S16 | 0.4276 | 0.4118 |
| S17 | 0.1031 | 0.1765 |
| S18 | 0.2381 | 0.1765 |

Fig. 3. Scatter plot of stakeholders showing their Bonacich out-power against Freeman out-degree.

Table 3

The top five information brokers and peripheral actors in the case project.

| Rank | (a) Information broker | | (b) Peripheral actors | | | |
|---|---|---|---|---|---|---|
| | Stakeholder | Betweenness centrality | Stakeholder | In-degree centrality | Out-degree centrality | Degree difference |
| 1 | S8 | 0.3107 | S12 | 0.4706 | 0.2353 | 0.2353 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 2 | S4 | 0.1297 | S10 | 0.4118 | 0.2353 | 0.1765 |
| 3 | S7 | 0.0793 | S9 | 0.1765 | 0.1176 | 0.0589 |
| 4 | S3 | 0.0532 | S6 | 0.3529 | 0.2941 | 0.0588 |
| | | | S16 | 0.4706 | 0.4118 | 0.0588 |
| 5 | S1 | 0.0485 | – | – | – | – |

Note: Degree difference was calculated by "Degree difference$_{Sa}$ = In-degree$_{Sa}$ − Out-degree$_{Sa}$" to identify peripheral stakeholders in the case project. These stakeholders act as information receiver more often than information provider.

on the actor to obtain information. Out-degree measures the extent that a stakeholder provides information to its direct neighbors. The higher the out-degree, the more influential a stakeholder is because its information can quickly reach a large population. As Meese and McMahon (2012) highlighted, it is "subjective and fuzzy" to distinguish between central connectors and non-central connectors. Plotting out-power against out-degree helps to identify central connectors who are respectable and influential in the information network. As shown in Fig. 3, all stakeholders are clustered in the blue shaded region except S1 (client project delivery division), S7, S3, S8 and S4. Accordingly, these five stakeholders are considered central connectors who are the direct information source that many others have heavily relied upon.

Table 3 shows the top five information brokers and peripheral actors in the case project based on betweenness and degree difference respectively. Betweenness centrality measures the extent that a stakeholder lies between two non-adjacent others in the network (Wasserman

and Faust, 1997). Stakeholders with high betweenness are considered information brokers, as they control the information flow to others whom may otherwise be disintegrated from the network.

Table 4

Priorities and influence levels of stakeholders according to their centrality index.

They play a leader role in the network as well by urging their neighbors to devote more to solutions for tackling project challenges (Hossain, 2009). As shown in Table 3, the top five information brokers are S8, S4, S7, S3 and S1 who are also central connectors in the case, indicating their criticality in project communication. As mentioned earlier, the proportion of ties with fair/poor quality and timeliness for S7 and S8 is quite high. The simultaneous roles of central connector and information broker for S7 and S8 raise urgent needs for them to improve their information quality and timeliness in information provision. Degree difference helps to identify peripheral information-seeking actors who have more incoming than outgoing links. Table 3 shows that the top five peripheral actors are S12 (electrical subcontractor), S10 (fit-out subcontractor for metalwork), S9 (fit-out subcontractor for timber work), S6 (structural engineer) and S16 (ELV subcontractor). It is not surprising that majority of them are subcontractors; as they possess specialized skills/knowledge which are peripheral in nature, they are relatively less perceived by others as useful information/knowledge sources. Another reason of being peripheral is that these stakeholders may not be eager to share what they know (Solis et al., 2013). Regardless of reasons,

| Priority | Stakeholder | Degree centrality | Betweenness centrality | Closeness centrality | Centrality index | Influence level in the project |
|---|---|---|---|---|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | S8 | 1.0000 | 0.3107 | 1.0000 | 0.7702 | 0.1053 |
| 2 | S3 | 0.8824 | 0.0532 | 0.8947 | 0.6101 | 0.0994 |
| 3 | S4 | 0.8235 | 0.1297 | 0.8500 | 0.6011 | 0.0936 |
| 4 | S7 | 0.7647 | 0.0793 | 0.8095 | 0.5512 | 0.0877 |
| 5 | S1 | 0.5882 | 0.0485 | 0.7083 | 0.4484 | 0.0819 |
| 6 | S16 | 0.4118 | 0.0079 | 0.6296 | 0.3498 | 0.0760 |
| 7 | S2 | 0.3529 | 0.0123 | 0.6071 | 0.3241 | 0.0702 |
| 8 | S5 | 0.3529 | 0.0023 | 0.6071 | 0.3208 | 0.0643 |
| 9 | S13 | 0.3529 | 0.0009 | 0.6071 | 0.3203 | 0.0585 |
| 10 | S6 | 0.2941 | 0.0025 | 0.5862 | 0.2943 | 0.0526 |
| 11 | S14 | 0.2941 | 0.0000 | 0.5862 | 0.2934 | 0.0439 |
| – | S15 | 0.2941 | 0.0000 | 0.5862 | 0.2934 | 0.0439 |
| 13 | S10 | 0.2353 | 0.0035 | 0.5667 | 0.2685 | 0.0351 |
| 14 | S11 | 0.2353 | 0.0000 | 0.5667 | 0.2673 | 0.0263 |
| – | S12 | 0.2353 | 0.0000 | 0.5667 | 0.2673 | 0.0263 |
| 16 | S17 | 0.1765 | 0.0000 | 0.5484 | 0.2416 | 0.0146 |
| – | S18 | 0.1765 | 0.0000 | 0.5484 | 0.2416 | 0.0146 |
| 18 | S9 | 0.1176 | 0.0000 | 0.5313 | 0.2163 | 0.0058 |

Note: Bold entries indicate the top five stakeholders in the case project according to the results of ‘influence level in the project'.

Table 5

The top ten stakeholder concerns in the case project according to their weighted importance values.

| Rank | Concern code | Stakeholder concern | Weighted concern importance |
|---|---|---|---|
| 1 | I9 | Ensuring the project to be completed within budget | 4.6433 |
| 2 | I19 | Processes and policies of getting statutory approvals and permits to carry out construction works | 4.6345 |
| – | I40 | Quality/performance of workmanship, materials and plants meeting the required standards | 4.6345 |
| 3 | I26 | Previous experience of the project team in undertaking similar construction projects | 4.5556 |
| – | I43 | Construction safety performance | 4.5556 |
| 4 | I38 | Project design accurately reflecting the requirements of client and end users | 4.5439 |
| 5 | I52 | Value engineering solutions and the associated design changes arising in the construction stage | 4.5088 |
| – | I7 | Adequacy and stability of project finance | 4.5088 |
| 6 | I22 | Effective decision making and maturity of the core leadership team | 4.5058 |
| 7 | I36 | Performance and attitudes of contractors and consultants | 4.5029 |
| 8 | I25 | Establishing trust, common understanding and mutual goals between client, contractors and consultants | 4.4444 |
| – | I35 | Clear specification, drawings and work instructions | 4.4444 |

| | | | |
|---|---|---|---|
| 9 | I34 | Alignment between design uniqueness, esthetics, budget, end users' requirements and the actual project programme | 4.4415 |
| 10 | I20 | Building common language, effective communication and mutual understanding between the project team and end users | 4.4298 |

peripheral actors signify the underutilized resources (Cross and Parker, 2004), implying high potential to explore new information from them.

Table 4 shows the priorities of stakeholders and their influence level in the project based on their centrality index. In this study, centrality index is the average of degree, betweenness and closeness of a stakeholder (Dogan et al., 2013). While degree and betweenness were explained earlier, closeness centrality measures the extent that an entire network is proximate to a stakeholder. The higher the closeness value, the closer a network is to the stakeholder. As Table 4 displayed, the top five stakeholders according to centrality index are again S8, S3, S4, S7 and S1, stressing their key roles in the information network. S8 is ranked the first, with the highest degree, betweenness and closeness scores. This result can be attributed to the responsibilities and expertise of S8. Since this case project is the first-ever purpose-built arts venue for Chinese opera with world standard in the city, S8 (as a theater planning and design specialist engaged early in the project) possess more specialized knowledge than other key stakeholders; leading to its higher control and influence on information flow than S1, S3, S4 and S7. The centrality index result shows that these five stakeholders control and contribute to the majority of information transmissions in the project; they are also the most economic information sources

since they have the shortest communication paths to other stakeholders, thus information can be obtained from them easily and economically (Dogan et al., 2013; Wasserman and Faust, 1997). Based on the centrality index result, the influence levels of stakeholders in the project are calculated by Eq. (1), as shown in Table 4. The obtained results are used in the next part to calculate the weighted importance of the identified stakeholder concerns.

### 4.3. Stakeholder concern priorities

Table 5 shows the top ten stakeholder concerns, among all 54 concerns, in the case project according to their weighted importance. The importance of a concern is calculated based on stakeholders' rating on the concern weighted by the influence level of each stakeholder, using Eq. (2). These ten concerns are worth particular attention from the project team because they are perceived as the most important issues and being most frequently communicated by stakeholders in the project. To explore the stories behind these key concerns and the major pitfalls in delivering large CBPs, the researchers conducted semi-structured interviews with stakeholder representatives of the case project, providing them with the results of SNA and concern priorities. The next section discusses the interview findings.

## 5. Findings on major pitfalls in delivering large CBPs

After the network analysis and concern prioritization, semi-structured interviews were conducted with the stakeholders. The results of SNA and concern prioritization were provided to the interviewees, they were then asked to explain stories behind the important concerns and the major pitfalls in delivering large CBPs. This section discusses the interview findings.

5.1. Developing accurate end users' requirements (EUR)

Performing arts organizations (including performers, operators and technicians) are major end users in this case. According to the interview findings, a major pitfall in the case project is to develop accurate requirements for these end users and to project them into the design brief. As pointed out by the interviewees, this pitfall was reflected by three key concerns in Table 5 (namely I20 ("building common language, effective communication and mutual understanding between the project team and end users"), I26 ("previous experience of the project team in undertaking similar construction projects"), and I38 ("project design accurately reflecting the requirements of client and end users")); and there are three main reasons attributing to this pitfall:

(a) Opera performers lacking sophisticated ideas about their needs. The interviewees opined that many performers lack sophisticated thoughts about their specific needs and requirements for the facilities and performance venue.

For example, neither do they realize the concept of acoustic design, nor do they recognize what settings are considered optimal for large-scale Chinese opera theaters. The interviewees stated that this might be ascribed to the history and art forms of Chinese opera. Unlike the Western one, early forms of Chinese opera greatly emphasize singing and costumes, they have simple stage setting (e.g. simply tables and chairs) and accompaniment, and do not have orchestra. Despite the evolution of Chinese opera during these centuries (e.g. being publicly staged in Chinese opera houses, incorporating more different kinds of instrumental accompaniment), many performers still have vague ideas when it comes to 'what they actually need in this modern purpose-built arts

venue'. As such, in the design stage, the project team faces challenges in developing accurate EUR.

(b) Unknown resident performing arts organization. As pointed out by the interviewees, the resident performing arts organization or operator has not yet been identified at the design stage, i.e. the actual main end user and its requirements are unknown. It adds extra difficulties to the design team in creating the right EUR because there are numerous forms of Chinese opera (e.g. Kunqu, Beijing opera); each having unique concerns on backstage facilities and venue setting. In this case, S2 engaged local organizations from various genres of Chinese opera, attempted to identify their common interests and establish a common ground for developing EUR. Although S2 considered this mechanism as effective, different views were obtained from the design team and end users. As some interviewees opined, it is challenging to consolidate the diverse needs of different art forms, as well as to decide a single voice as their representative. They asserted the importance of identifying the resident operator at the outset of CBPs; otherwise, it is hardly likely to build accurate EUR and accommodate the real needs of future end users. (c) Inadequate experience of undertaking similar projects. As most interviewees indicated, there are rare local/ overseas examples of purpose-built performance arts venues for Chinese opera, and they cannot simply take reference from the existing typical opera houses worldwide since the art forms of Western and Chinese opera are substantially different. The project team has inadequate experience in executing projects of similar nature and scale. It is also difficult to engage designers and contractors with such experiences.

The main reasons for the challenge of building accurate EUR in CBPs have been discussed above. To improve the situation, apart from early identification of resident operator, the interviewees asserted the importance of having stakeholder engagement facilitators in CBPs for the whole project period, and suggested S2 to strengthen such role and capability. For instance, by comparing Fig. 2(a) and (c), S2 should improve its information exchange with other four key stakeholders (S3, S4, S7 and S8) in terms of information quality and timeliness in access. As such, S2 can be a strong information broker between S18 and all key stakeholders, where end users' needs and views would be more directly communicated to these parties.

### 5.2. Achieving a balance between esthetics, functionality andproject resources

Many vast-scale cultural facilities are constructed in esthetic and unique appearances. Striking a well balance between design uniqueness, esthetics, functionality and project resources (e.g. cost and time) is another major pitfall of CBPs from stakeholder perspective. According to the interviewees, this pitfall was indicated by I34 (“alignment between design uniqueness, aesthetics, budget, end users' requirements and the actual project programme”) in Table 5; and it can have substantial practical implications on three other key concerns namely I9 (“ensuring the project to be completed within budget”), I19 (“processes and policies of getting statutory approvals and permits to carry out construction works”), and I52 (“value engineering solutions and the associated design changes arising in the construction stage”).

The interviewees further explained some main reasons leading to such pitfall. The client's initiatives behind large CBPs are often more than simply meeting the community's demands for having permanent sites to accommodate its cultural and educational aspirations. Many

CBPs are commissioned to serve as emblems of civilization for how a city exhibits itself on the national and international stage; besides being packaged as new landmarks to revive the sluggish local community and attract more visitors. As such, the project proponent and funders often have a strong desire towards remarkable and esthetic architectural design; and in certain extent, this iconic structure can embody how the project leadership group defines and perceives as its triumph. In many large CBPs, as in this case, the client selects architectural design and design team by means of design competition. In order to win, contestants often put greater emphases on design uniqueness and esthetics, than on practicality and buildability, in their design. An architect's fame is also an important selection criterion of the client's selecting committee, where the well-known architects are often instinct with creativity to invent designs that are imaginative yet may be hard to implement. The interviewees stated that, to successfully deliver the project, it is crucial for the budget plan and actual project programme to sufficiently acknowledge its design uniqueness and esthetics. However, in many instances, the executive leadership group is over-optimistic in its design selection judgment and project planning. The budget, time, functionality and esthetics are mismatched at the outset, and this discrepancy is often not realized until the construction stage. Consequently, to maintain cost effectiveness and the value for money, many value engineering solutions and associated change orders arise after the construction commences, such as cutting off some planned components which are found to be too costly or impractical to build. Finally, these result in extra cost and time to accommodate changes during construction, with the building's esthetics being compromised somehow.

As declared by the interviewees, in future CBPs, the project leadership group should achieve a balance between practicality and esthetics in its judgment of design selection. It is important to ensure the design is functionality-driven, instead of creating a masterpiece for ornament. In addition, the team should fully reflect the design uniqueness and project complexity in the cost

plan and programme at the outset; as well as staying alert to the likely cost impacts of variation orders. Finally, it would be beneficial to think thorough the EUR prior to the selection of design and design team, so as to minimize potential alterations to the design proposal.

### 5.3. Project leadership team makeup, vision, charisma andlearning stance

The successful delivery of large CBPs, from initiation to operation, requires the core leadership team to have a clear vision, possess the necessary knowledge and experience, and effectively exercise its decision making power. From the stakeholder perspective, another major pitfall in this case concerns about the makeup, vision, charisma and learning stance of the project leadership group. According to the interviewees, this pitfall was indicated by I22 (‘effective decision making and maturity of the core leadership team’) in Table 5; and it can impact other key concerns such as I9, I38, I34, I20 and I52.

The interviewees elaborated main reasons and consequences of this pitfall. Many CBPs adopts an approach of ‘cross-sector collaboration within a single organization’ for project governance and administration (Woronkowicz et al., 2014). In this case, the focal organization is a new enterprise particularly established to deliver the case project and a series of subsequent developments. Its core leadership is formed by assembling experts from various sectors into a team, with an intent that their cross-sector collaboration can effectively oversee different aspects of the project and strive towards successful project delivery. This mechanism has been described in previous studies, where Kania and Kramer (2011) named it collective impact and defined it as “the commitment of a group of important actors from different sectors to a common agenda for solving a specific social problem”. The interviewees suggested four important factors for this mechanism to work well in the context of major CBPs:

(a) Picking the right people. It is important to decide ‘who are counted in’. The leadership team should be a well combination of the right people with the right knowledge and extensive experience. As opined by the interviewees, the core leadership of this project has engaged right people from various disciplines at the early beginning, such as Chinese opera, commerce and finance, construction management, technology, and marketing.

(b) Having a clear and coherent project vision. After the formation, it is crucial for the core leadership to set clear project vision and goals, and communicate them well to the project team and all stakeholders. Since large CBPs often take many years to complete, the leadership group may undergo states of transitions. The group should keep the grand vision coherent throughout the project delivery process even in case of leadership change, so as to minimize cost and time implications caused by change vision and scope.

(c) Having charisma in the core leadership team. The leadership board of CBPs is often a disparate group of experts from various sectors. Due to their discrete background and expertise, in spite of the shared project vision, conflicting views and disconnection can easily arise among board members. It is thus vital to have a ‘charisma’ or ‘central figure’ in the core leadership to consolidate the diverse views of board members, and to make final judgment when necessary. The interviewees gave an example — they faced a dilemma, in construction stage, of increasing budget or cutting off some planned elements to reduce cost overrun; however, diverse opinions of board members have led to endless discussion in the absence of charisma. Without an actual leading head, the project leadership group can hardly exercise its decision making power in an effective way, and steer the project towards a successful end.

(d) Having sufficient time for the learning process. Every new organization, including its core leadership, needs learning curve before being able to smoothly initiate and run

projects, as well as to make its internal policy and mechanism well established. As the interviewees stated, the project delivery would be smoother if more time is allowed for the focal organization and the project itself to ‘germinate’ before actual development; otherwise it would just become a process of trial-and-error.

## 6. Conclusions

Stakeholders in a large CBP can and should influence project decision making and execution. Addressing stakeholder complexity and understanding major pitfalls in project implementation from the stakeholder perspective are therefore indispensable in CBP management. This study uses a combination of rationalistic and empirical stakeholder analysis methods to address stakeholder complexity in CBPs. First, through the stakeholder management theory and social network theory, this research rationalistically analyzed the real stakeholder interaction patterns by using SNA, recognized the key actors in these relational structures, identified opportunities to improve stakeholder information exchange, and identified critical concerns which were frequently communicated by stakeholders during project implementation. Since adopting a single analytical perspective might not yield a complete understanding, interviews were conducted with all stakeholders to triangulate and supplement the SNA results, identify the major CBP pitfalls accordingly, and look into their underlying reasons and potential solutions from an empirical perspective.

Through case study of a large performing arts center presented in this paper, thedetailed analytical variables andproceduresofthis holistic stakeholder analysis process were clearly demonstrated. The application of SNA identified influential, mediating and peripheral stakeholders in project information exchange; and evaluated the importance of stakeholder concerns. Complementing the quantitative assessment results with interview findings

identified three major pitfalls in CBP developments. The outcomes showed that variations of different art forms and without deciding the resident operator prior to design can bring extra difficulties to developing an accurate EUR. The core leadership team should also pay particular attention to avoid planning fallacy; because large CBPs, which are often in esthetic and remarkable design, may be exposed to higher cost and schedule risks than typical construction projects, when the design uniqueness and technology complexity are not adequately acknowledged in cost plan and programme. Besides, having a charisma, clear vision, and well combination of the right people in the core leadership team are also crucial to the governance and administration of large CBPs.

The limitations of this study comprise the practical difficulties in engaging all stakeholders due to their concerns on confidentiality, the lack of longitudinal studies to investigate the dynamics of stakeholder relationships and social network, and the limited context of the single case study. In addition, the researchers faced practical difficulties in knowing whether the case study findings have been actually used by project leaders, and the extent of actual impacts (if being used); due to two reasons: (1) the case project is still ongoing, thus the ultimate project outcomes are not yet known; and (2) in reality, a series of project governance and administrative procedures will have to be gone through across various hierarchies, before the study findings could be actually used to develop stakeholder management measures for actual enforcement. Also, the network metrics used in this study do not represent the sole metrics useful for analyzing social interactions in construction projects; there are many other metrics to interpret relationships in projects meaningfully from different angles. Further empirical studies in other CBP types (e.g. museums and theaters) and using other SNA metrics should be conducted in future.

Notwithstanding the above limitations, this study contributes to previous literatures by using a holistic stakeholder analysis approach to analyze and address stakeholder complexity in CBPs. The rationalistic perspective of this approach can help identifying completely all CBP stakeholders and their concerns, depicting stakeholder information exchange interactions, deciphering structural features of these relationships, evaluating stakeholder influences and concern importance, as well as identifying the critical project stakeholders and concerns. The empirical perspective of this approach, which has complemented the rationalistic outcomes, can provide useful insights on the major CBP pitfalls. Compared to previous studies which mainly adopt a single analytical perspective, this approach brings the benefits of complementing quantitative stakeholder assessment results with qualitative information to facilitate a complete understanding on the actual problems encountered by stakeholders in large CBP developments. The holistic stakeholder analysis process can be employed in other complex project environments for addressing stakeholder complexity and providing basis to formulate stakeholder management measures. This paper is one of the few studies investigating CBPs from stakeholder perspective in the project management field. Despite the limited context of a single case, the major CBP pitfalls reported in this paper can offer practical values to practitioners who are involved or take the lead in managing and implementing large CBPs, the possible causes and recommendations discussed can also bring them useful insights when they deal with similar problems in future CBPs.

## Conflict of interest

There is no conflict of interest.

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