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Public Participation Performance in Public Construction Projects of South China: A Case Study of the Guangzhou Games Venues Construction

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Abstract

Over the past decade, public participation has been increasingly implemented in Chinese public construction projects (PCPs) to facilitate their smooth execution at the micro level and to promote collaborative governance at the macro level. However, only a limited number of studies have systematically evaluated participation performance in Chinese PCPs. This study aims to develop a public participation performance index (PPPI) for promoting the implementation of public participation in Chinese PCPs. An initial list of 15 key performance indicators (KPIs) was compiled through a literature review and refined by a pilot survey with selected experts. Based on this list, a questionnaire survey instrument was developed and used to collect the opinions of 192 participants with various stakeholder roles in different PCPs in South China. A composite PPPI for PCPs in South China, which consists of six out of 15 KPIs, was then constructed according to the survey results. The Guangzhou Asian Games venue construction was selected as a case study to illustrate the use of this index. The PPPI has great potential for future application in participation practices. Although this index is developed in China, the research method can be replicated in other developing countries to develop similar indices for international comparisons.

Keywords: Public participation, Performance index, Public construction project, Survey, China

1. Introduction

Over the past two decades, a growing number of public construction projects (PCPs) in China have been initiated to address the needs of rapid urbanization and economic development. Although these projects accelerated regional economic development and urban renewal (Flyvbjerg et al., 2003), they also produced a significant negative effect on urban transportation, environment, and lives of local residents, thereby intensifying interest disputes and increasing environmental complaints from the public (Flyvbjerg et al., 2003; Li et al., 2013; Shan and Yai, 2011). For instance, a maglev line extension project in Shanghai encountered significant public protests because of its potential negative environmental effects (Huang, 2010).

To address these disputes, public participation has been increasingly promoted as a solution since the 1990s (Tam et al. 2009; Li et al., 2012; Shan and Yai, 2011). Participation is "a process through which stakeholders influence and share control over priority setting, policy making, resource allocation and access to public goods and services" (World Bank, 2013). Furthermore, public participation is widely used in developed countries as an effective approach to improving decision making outcomes, public project execution and collaborative governance (Enserink and Koppenjan, 2007). Irvin and Stansbury (2004) emphasized that the ultimate purpose of implementing public participation in developed countries since the 1950s is enhancing the requirement of democratic governance at the macro level. Since their first introduction to the environmental impact assessments of Chinese PCPs in the 1980s (Plummer and Taylor, 2004), public participation initiatives have been increasingly applied to various phases of PCPs, such as land acquisition, planning, design and construction, over the past two decades (Xie et al., 2013).

Owing to the rapid development of public participation in China, a growing number of studies have examined the effectiveness of this new method (Enserink and Koppenjan, 2007; Li et al., 2012&2013; Ning et al., 2015; Plummer and Taylor, 2004). However, these research efforts are qualitative gap analyses, and they seldom quantitatively and systematically address participation benefits that should be derived from the sound implementation of public participation. As noted by Sanoff (2000), measuring public participation performance plays a pivotal role in enhancing its practical development; such development not only helps project stakeholders build consensus on project decision-making and development at the micro level (e.g., less negative environmental impacts on nearby communities, reduced project conflicts),

it also enhances the establishment of collaborative governance at the macro level (e.g., democratic decision making, more job opportunities) (Enserink and Koppenjan, 2007; Wang, 2001). However, these studies seldom systematically explore the performance requirements of various project stakeholders on public participation activities or provide a pragmatic index tool to guide the participation practices in Chinese PCPs. Irvin and Stansbury (2004) also emphasized that implementing participation-based projects requires a systematic performance evaluation for benchmarking because values and outcomes are essential in evaluating the effectiveness of public participation. Therefore, this study aims to develop a public participation performance index (PPPI) that can systematically measure the performance and promote the development of participation practices in PCPs in South China.

A conceptual participation performance framework that consists of 15 key performance indicators (KPIs) was first formulated by reviewing the literature on performance measurement in participation-related projects. Second, these indicators were used to develop a questionnaire for collecting the opinions of various stakeholders involved in Chinese PCPs. Third, a composite PPPI for PCPs in South China was then derived from the survey results. Fourth, a case study of the Guangzhou Asian Games venue construction was conducted to illustrate the application of this index. Finally, the evaluation results of the case study as well as the significance and limitations of this study are discussed.

2. Public Participation Performance in Public Projects

Although evaluating public participation performance is pivotal to its practical development (Sanoff, 2000), this issue has not been fully examined in the literature (Lach and Hixson,

1996). In contrast to western countries with a tradition of participatory democracy, several developing countries, such as China, have attempted to implement public participation initiatives to reduce conflicts of interest and to facilitate the smooth execution of public projects or services. Meanwhile, numerous studies and reports stated that the participation requirements in public services and projects could also be triggered by the ever-increasing population of middle classes in the Chinese society, which is driven by constant economic growth. Their participation needs in public services and affairs have been widely accepted as the origin of earliest public participation initiatives (Moore, 1966; Shambaugh, 1996; Economist, 2009).

An extensive review of related international and Chinese literature published between 2000 and 2013 (the methodology will be reported later) has revealed 15 KPIs used to evaluate the effectiveness of public participation in PCPs in developing countries particularly in China. Furthermore, this study classified the performance of public participation in PCPs into two kinds, namely, micro- and macro-levels (Table 1), by extending a twofold categorization framework of public participation effects for public decision making (e.g., process and outcomes) by Irvin and Stansbury (2004). The former refers to direct and immediate effects of public participation activities implemented on the project decision-making and development processes at the micro-level, while the latter refers to long-term effects on governance that emerge from the participation process, particularly the social and political effects.

(Please insert Table 1 here)

2.1 Macro-level Participation Performance

Arnstein (1971) introduced the famous eight-rung ladder framework of citizen participation, in which public participation is regarded as a useful index for improving the democracy level of the public affair and service mechanism in a society by maximizing the use of various forms of participation across all related major activities. This framework has been widely advocated by numerous scholars in both developed and developing countries; and it has also been used to examine whether the public participation initiatives in China or in other developing countries can effectively address the democracy requirements (i.e., land acquisition, design plan selection, and project execution) in the decision making and execution of PCPs (Shan and Yai, 2011). By reviewing all the public participation requirements cited in the urban planning ordinances of 27 provincial capitals and 4 municipalities in the country, Shan and Yai (2011) found that China is at the tokenism level of the eight-rung framework of citizen participation, i.e. the public is mainly informed and consulted.

The direct yet classic explanation for the macro-level public participation performance has included some controversies due to the emerging public participation practices in developing countries such as China (Shan and Yai, 2011). Earlier qualitative studies by Li et al. (2012 & 2013) and Shan and Yai (2011) (e.g., using interviews, archives, and case studies, etc.) have revealed five macro-level KPIs of public participation in Chinese public projects (i.e. KPI1, KPI2, KPI3, KPI4, and KPI5), as shown in Table 1. Meanwhile, a large-sample survey in major Chinese cities resulted in similar findings that most of these KPIs or their equivalent received a supporting ratio of at least 30% of all survey respondents (Xie et al., 2012).

These KPIs comply with a recently emerging perspective in which public participation can be implemented as a part of collaborative governance effects with the aim to transform modern states in order to enhance public satisfaction (Newman et al., 2004). From a governance perspective, democracy is widely accepted as an integral part of good governance (Rothstein and Teorell, 2008). Recent studies in this area revealed several positive governance effects, such as trust in the government (Mizrahi et al., 2010) and improved governmental accountability (Kim and Schachter, 2013). A participation survey in China has also confirmed that democracy is widely accepted as a mechanism to maximize the life satisfaction of Chinese citizens by increasing government accountability (Cheung and Leung, 2006). Therefore, public participation is considered an appropriate approach to realizing this aim in China.

2.2 Micro-level Participation Performance

Compared with western developed countries, reducing potential socio-economic or environmental conflicts and facilitating the implementation of PCPs are more widely accepted idea for promoting public participation activities in public projects in China and other developing countries (Manowong and Ogunlana, 2006). Public participation practices in China first appeared in internationally-aided projects to satisfy related requirements of international organizations such as the World Bank (Plummer and Taylor, 2004). Based on its two-decade practice in aiding the construction of infrastructure projects in developing countries, the World Bank (2006) found that public participation could help achieve project success and sustainability. Combined with recognizing the rapid increase of socio-economic and environmental conflicts in PCPs in China and developing countries, public participation

has been considered as a key solution to solve these disputes and to facilitate the smooth implementation of PCPs since the 1990s (Li et al., 2012; Shan and Yai, 2011; Manowong and Ogunlana, 2006). As shown in Table 1, 10 KPIs (i.e. KPI6–KPI15) are related to this aspect. Most of these KPIs refer to the process or goal-setting issues of a specific PCP during its execution, such as the KPI8, KPI11, KPI12, KPI13, KPI14, and KPI15. Most of them were validated by the large-sample survey as key issues concerned with various project stakeholders in implementing public participation activities. Recognizing that the more and more governments of major cities in China have gradually incorporated public participation requirements into PCP planning, three KPIs (i.e. KPI6, KPI7, and KPI10) relating to this issue have also been identified and considered in this study. In addition, to achieve its energy conservation target before 2020, the central government promulgated a new *Design Standard for Energy Efficiency* in public building (Hong et al., 2015); thus, KPI9 has been identified and increasingly recognized as a key issue in implementing public participation in PCPs.

Public participation performance in PCPs in China and other developing countries remains a highly debated topic in the literature (Sanoff, 2000; Almer and Koontz, 2004; Manowong and Ogunlana, 2006), but recent studies have provided more evidence to support positive participation performance effects which enhance the smooth execution of PCPs in China (Shan and Yai, 2011; Huang et al., 2015; Li et al., 2012 &2013). Nevertheless, it is not strange to hear negative issues (e.g., conflicts caused by land expropriation, noise and dust complaints during project execution, and protest against maglev lines) reported in mass media once a while which may be a result of insufficient public participation (Huang, 2010; Huang and Yu, 2010; Huang et al. 2015).

3. Research Methodology

This study aims to develop a public participation performance index (PPPI) for promoting the implementation of public participation in Chinese PCPs. The PPPI development adopted the method suggested by Yeung et al. (2007 & 2009). Compared with other main performance measurement techniques commonly used in the construction field (i.e. gap analysis, statistical methods, and data envelopment), the integrated performance index has significant merits in integrating the benchmark requirements of various stakeholders and providing a single unified guide to practice (Yang et al., 2010).

The entire PPPI development process consists of three steps: (1) identification of potential KPIs and development of questionnaire instruments, (2) implementation of the survey and identification of KPIs, and (3) development of the PPPI. Accordingly, a literature review and a pilot survey were first conducted to identify the preliminary list of KPIs. Second, an empirical questionnaire survey was used to collect importance ratings against each KPI from various project stakeholders involved in PCPs as performance measurement is a well-known construct commonly used in benchmarking participation practices. Finally, a case study in South China, namely the Guangzhou Asian Games Venue construction, was conducted to illustrate the implementation of the developed PPPI.

This study adopted a linear and additive performance index proposed by Yeung et al. (2007), who used this index to evaluate the partnering performance of construction projects in Hong Kong. Similarly, a PPPI was developed to measure the performance of participation-related projects, as shown in Eq. (1):

$$PPPI = \sum_{i=1}^{n} KPI_i \times W_i \quad \text{Eq. (1)}$$

Where PPPI—the project performance index

KPI_i —a particular KPI_i

W_i— the weighting of a particular KPI_i

3.1 Identification of KPIs and development of questionnaire instruments

Several KPIs should be identified is to examine the benefits that can be obtained from public participation in PCPs. Furthermore, the identification of KPIs is the first step to establish the PPPI. Several rounds of literature reviews were undertaken in this study to identify the KPIs used to benchmark public participation in China and other developing countries, particularly those in the Asia. This study first adopted the Scopus search engine to identify the research published in peer-reviewed journals regarding public participation practices in construction projects in China and other developing countries. This is because most research in the area was published in journals for the construction fields (Xie et al. 2012) and the Scopus is one of the largest databases with more than 20,000 journals that has been commonly used by construction researchers to conduct systematic literature reviews (Ke et al, 2008; Hong et al., 2011). In addition to the keyword "construction project," several search keywords on public participation (e.g., public engagement, public involvement, civic engagement, citizen participation, community participation, public consultation, and public voice) were used in the Title/Abstract/Keyword field of related disciplines in the search engine. Based on the identified papers and their references, the literature was further reviewed to identify relevant research published in seminal monographs, reports and peer-reviewed journals outside the

construction and environment fields via Google Scholar. Finally, a database of related international literature, especially those published between 1993 and 2012, was established. The scope of the reviewed journals not only involved those in the construction and environment science fields such as the *Journal of Urban Planning and Development, Engineering Construction and Architectural Management, and Habitat International,* which were identified in the earlier study (Xie et al., 2013), but was also expanded to journals in other fields, such as business, management and accounting, and social sciences, such as *Public Administration Review,* and *Public Performance and Management Review.* Recognizing that the number of related papers published in international peer-reviewed journals was scarce, several Chinese literature such as monographs and papers in peer-reviewed journals were used as a complement. Finally, 15 KPIs were identified as shown in Table 1. Through the interviews, the identified 15 KPIs were also verified by eight experts in the areas reported in an earlier study (Xie et al., 2012).

Based on the 15 KPIs, a questionnaire survey instrument was developed and tested with a small sample of selected academic and industrial experts. Invitations were sent to target respondents by e-mails or through telephone calls in the late part of 2013. Consequently, 17 experts agreed to participate in the pilot survey. Over half of them (9/17) were from the industry and possessed hands-on experiences in construction. In addition, all respondents met the following criteria: (a) over five years of industrial experience, (b) involvement in participation-related projects, (c) senior positions in their organizations, and (d) sound knowledge on public participation to manage PCPs. Seventeen valid responses were recorded for subsequent data analysis. In the pilot survey, the 15 identified KPIs received mean values

ranging from 3.76 to 7.29 on a 9-point Likert scale. The pilot survey results indicated that the 15 selected KPIs could sufficiently represent the performance of or benefits from the participation activities in PCPs as a whole; furthermore, no new KPIs were identified. Meanwhile, according to the feedback from the pilot survey, some descriptions were added to several KPIs in the questionnaire for future survey participants to easily understand them.

3.2 Implementation of the Survey and Selection of Appropriate KPIs

After the survey instrument was developed, a questionnaire survey was conducted to obtain the relative importance of the 15 KPIs. All respondents were asked to evaluate the relative importance of the 15 KPIs based on a five-point Likert scale from 1 = very low to 5 = very high. To obtain a balanced perspective, the target participants for the survey included not only the general public, but also respondents from the main stakeholders in construction projects, such as the government, clients, contractors, designers, and consultants. In particular, respondents from stakeholders in construction projects should meet the following criteria: (a) over five years of industrial experience; (b) involvement in participation-related projects, (c) senior positions in their organizations, and (d) sound knowledge on public participation to manage PCP practices. Invitations were sent to the target respondents during the professional development courses provided by the South China University of Technology in Guangzhou city. In addition, 23 Master students from the South China University of China, who were involved in public participation in PCPs, were chosen as representative of the general public and invited to participate in the survey. The university implemented several building renovation and construction projects within the campus, which included the renovation of a sporting stadium used as part of the Guangzhou Asian Games venues, thereby allowing these

students to have more opportunities to participate in public participation activities in PCPs. As the general public involved in public participation practices might have various professions, the use of single-profession participants, such as Master students, might not fully reflect the complete opinion of the public on the issue. The survey was undertaken from late 2014 to 2015. The city is the largest and most developed city in South China. Consequently, 192 valid responses were recorded for subsequent data analysis. Table 2 shows the profiles of 192 respondents.

(Please insert Table 2 here)

To assess the internal consistency of the 15 KPIs, the coefficient alpha (Cronbach's alpha) was adopted in this study. The value was 0.879, indicating that the five-point Likert-type ratings provided by the participants were reasonably reliable. As more than half (57%) of the participants involved in the survey were from contractors, an inter-group comparison analysis was undertaken to ascertain whether the survey participants from contractors and non-contractor stakeholders (e.g., the government, clients, designers, consultants, and the public) have significantly different opinions on the importance ratings of all the 15 KPIs. As shown in Table 3, only two KPIs, i.e. KPI7 and KPI13, have a p-value lower than 0.05, indicating that the participants from contractors had significantly different opinions from other stakeholder participants involved in PCPs. Thus, these two KPIs were deleted from the subsequent analysis.

(Please insert Table 3 here)

Based on the index development process suggested by Yeung et al. (2007 & 2009), only the KPIs with relative importance ratings equal to or greater than the threshold value were regarded as KPIs and used to construct the PPPI. These KPIs were then verified by a correlation analysis. A Pearson correlation analysis was conducted to examine whether a multiplier effect exists among the identified KPIs. Only KPIs that were marginally correlated with each other were used as appropriate KPIs for the PPPI.

Table 3 indicates the ranking of the 15 KPIs in terms of their relative importance. In this study, only KPIs with a normalized value greater than 0.6 can be regarded as KPIs. Six KPIs met this criterion based on the survey results, comprising (1) KPI1 (normalized value = 1), (2) KPI8 (normalized value = 0.97), (3) KPI4 (normalized value = 0.93), (4) KPI5 (normalized value = 0.68), (5) KPI2 (normalized value = 0.65), and (6) KPI3 (normalized value = 0.65).

Based on the data from the six selected KPIs obtained from the feedback of the survey, Pearson correlation analysis was conducted to examine the correlation among these KPIs. According to Yeung et al. (2007), only KPIs that have no significant correlation with each other can be used to construct a linear and additive performance index. Table 4 indicates that most of the six KPIs (14 out of 15 coefficients) are insignificantly correlated with each other at the 5% significance level, and their coefficients all have a value of less than 0.5. Therefore, the six KPIs are appropriate for the construction of the linear and additive index, which is showed in Eq. (1).

(Please insert Table 4 here)

3.3 *Development of the PPPI*

Chow (2005) indicated that the weight of each selected KPI can be calculated based on the

survey result by using Eq. (2). Take the calculation of W_{KPI1} for example, the weighting of this KPI (W_{KPI1}) is computed by dividing the mean rating of KPI1 (M_{KPI1}) based on the ratings of relative importance given by 192 survey respondents, by the summation of meaning ratings of all six selected KPIs (KPI1, KPI2, KPI3, KPI4, KPI5 and KPI8).The weightings of other five selected KPIs could be obtained by conducting similar computing process.

$$W_{KPIa} = \frac{M_{KPIa}}{\sum_g M_{KPIa}} \quad \text{for } a = 1 \qquad \text{Eq. (2)}$$

Where a— the numeric code of the six selected KPI used for development of the PPPI (e.g., '1', '2', '3', '4', '7' and '8');

W_{KPIa}—the weighting of a particular selected KPI;

M_{KPIa}—the mean rating of a particular selected KPI;

$\sum_g M_{KPIa}$—the summation of mean ratings of all six selected KPIs.

(Please insert Table 5 here)

Table 5 indicates the weightings of the six selected KPIs: (1) KPI1 (0.174), (2) KPI8 (0.172), (3) KPI4 (0.171), (4) KPI5 (0.162), (5) KPI2 (0.161), and (6) KPI3 (0.161). They involved one micro-level KPI (KPI8) and five macro-level KPIs (KPI1-KPI5), which revealed the perception of most stakeholders involved in Chinese PCPs on public participation performance that public participation initiatives in PCPs should focus more on macro-level performance issues rather than micro-level performance ones. This complies with the findings of earlier studies by Li et al. (2012 & 2013) and Shan and Yai (2011). Based on these KPIs, a composite index to measure the performance of public participation in PCPs can be developed using the following formula:

PPPI=KPI1×0.174+KPI8 ×0.172+KPI4×0.171+KPI5×0.162+KPI2×0.161+KPI3×0.161

Eq. (3)

4. Case Study

To illustrate the use of the PPPI, a case study was developed, where participation performance related to the six KPIs was examined using the PPPI. The illustrative case is commonly used as a companion to explain the use of the integrated performance index or similar performance evaluation techniques (Yeung et al., 2009; Hu et al., 2016)

4.1 Case Background

As the largest event in the history of the Asian Games, the Guangzhou Asian Games was hosted by Guangzhou City, and co-hosted by three nearby cities, Dongguan, Foshan, and Shanwei. To provide world class hardware for the Games, eight new venues (one training venue and 7 competition venues) were constructed and 62 venues (16 training venues and 46 competition venues) were renovated (Guangzhou Asian Games Organizing Committee, 2010). The total construction, renovation, and operation costs of these venues were USD 1 billion (RMB 6.3 billion), which were directly invested by the government. Given that most sporting venues are located in Guangzhou, this study mainly considered the newly constructed and renovated venues in Guangzhou City. The duration of the construction project was 36 months from September 2007 to August 2010. This project was regarded as one of the largest PCPs in the city since 1949. All the venues were constructed and completed on time (Tan, 2010). Following the successful experiences of Beijing Olympics Games venue construction (Sun et al., 2008), the Guangzhou municipal government established a mega-event headquarters to create a centralized control of the renovation and construction works of all venues. In addition to delivering the high-quality venues on time and within budget, the Guangzhou municipal

government also made significant efforts to improve the environment in the city. For instance, it invested nearly USD 400 million (RMB 2.4 billion) in enhancing urban air quality (Qiu, 2009), thereby ensuring the best air quality in the city during the Asian Games period since 2004 (Yang and Sui, 2010). To improve the decision making and construction management process, online public votes on the selection of design plans for the new venues and a complaint hotline 12329 that mainly involved local residents were both employed to collect public opinion on project decision making and construction.

4.2 Data Collection and Analysis

Another questionnaire survey was conducted to obtain the ratings of participation performance in the case study. Out of the 17 experts working in Guangzhou involved in the pilot survey, 16 were further invited to provide ratings on the six selected KPIs for the Guangzhou case. Finally, nine of them with sound knowledge on the public participation of the case project agreed to participate in the survey. All nine respondents were asked to evaluate the performance of the six KPIs in the case study based on a nine-point Likert scale: 1 = very unsatisfactory, 2 = unsatisfactory, 3 = moderately unsatisfactory, 4 = slightly unsatisfactory, 5 = acceptable, 6 = slightly satisfactory, 7 = moderately satisfactory, 8= satisfactory, and 9 = very satisfactory. Considering that the sample size was small, the use of the nine-point Likert scale not only enhances the rating habits in China (Xia et al., 2009), but also helps produce more accurate results. Consequently, nine valid responses were recorded for subsequent data analysis.

(Please insert Table 6 here)

Based on the mean ratings provided by survey respondents (see Table 6), the PPPI of the case study can be calculated according to Eq. (3):

$$4.00\times0.174+5.67\times0.172+4.11\times0.171+4.67\times0.162+2.56\times0.161+5.11\times0.161=4.40$$

The PPPI was 4.40, slightly lower than 5.00, indicating that participation performance in the case study failed to achieve the acceptable performance level, which seemed to reinforce the opinion of the news report (Huang and Yu, 2010) that urban residents were dissatisfied with the environmental performance of the case project and complained about this issue. This finding can be attributed to the main forms of public participation used in the case study only involved online public votes and a complaint hotline, which could not yield satisfactory performance with regard to the selected KPIs, compared with the expected forms of public participation in an earlier survey (Xie et al., 2014). An in-depth analysis of the public participation effect on each KPI in the case study was examined. The only micro-level performance indicator, i.e., KPI8 “prevent and mitigate negative environmental impacts on local residents”, ranked first with a mean rating of 5.67, near the moderately satisfactory performance level. This indicated that the use of complaint hotline established by the government to collect public opinion (mainly public complaints) still had some positive effects on preventing and mitigating negative environmental impacts; however, it remained inadequate to prevent and mitigate several negative environmental impacts (e.g., dust, noise, and traffic jams) on the local residents, which resulted in the unusual event in which the Guangzhou mayor publicly apologized to the local citizens in early 2010 for the massive environmental issues (Huang and Yu, 2010). Other forms of participation, such as

publicly-participated monitoring process committee, could improve performance in this respect.

The residual five KPIs of PPPI were related to the macro-level participation performance in PCPs. KPI3 ranked second with a rating of 5.11, indicating that this KPI achieved acceptable performance. The ratings of the four remaining KPIs (KPI5, KPI1, KPI4 and KPI2) were 4.67, 4.11 4.00, and 2.56, respectively. Four of them were close to the acceptable performance levels, which indicated that the online public votes for project design in the case project were perceived to have some positive effects on these issues related to collaborative governance at the macro level. Similar to the use of the complaint hotline for the micro-level participation performance, utilizing the single participation method could not ensure necessary participation performance at the macro level. In addition to the limited use of participation forms in the case project, another cause for the lack of sufficient macro-level participation effects can be attributed to the nature of the case project. Although all Guangzhou Asian Games Venues were directly invested by the local government and assumed as a public project, numerous scholars have stated that a sporting mega-event should not receive the aid of public funding in case it cannot yield sufficient macro-level effects, such as more job opportunities and economic growth in the region, similar to other public projects (Andranovich et al. 2001). This issue which involves an ongoing political debate on the role of government in sporting mega events emerged in the past and persists until today (Andranovich et al. 2001; Horne, 2007; Müller, 2011). The case in this study seemed to indicate that the case project should be regarded as a quasi-public project and might have less macro-level participation effects than real public projects do.

In summary, the case study results are consistent with the observation of Shan and Yai (2011) that public participation practices in China remain in the emerging phase. Recognizing that achieving macro-level participation performance which enhances macro-level collaborative governance involves an evolving process. The Chinese government should try other forms of participation in such public megaprojects for better collaborative governance at the macro level in the long run.

5. Research Significance, Practical Implication and Limitations

Apart from receiving strong support from the central government and top leaders in the country (Hu, 2007 & 2012; Huang et al., 2016), the practices of public participation in PCPs in the major Chinese cities have developed slowly and seldom yielded satisfactory results (Li et al., 2012; Shan and Yai, 2011). According to Arnstein (1969), public participation practices in China are at the tokenism level of the eight-rung ladder of citizen participation, in which the public is informed and consulted (Shan and Yai, 2011). Therefore, this issue must be investigated to accelerate the development of public participation in practice.

This study made a significant contribution to theory by conducting a systematic evaluation of KPIs used to benchmark participation performance in PCPs of South China. This work first identified 15 KPIs to assess the performance of public participation in PCPs in the context of China by proposing and validating an integrated framework consisting of macro- and micro-level ones. All the 15 KPIs received a mean value between 3.37 and 4.28, indicating that these selected KPIs are appropriate and can be used to benchmark the performance of public participation in Chinese PCPs. This framework has not only validated

the finding of earlier studies related to the micro-level performance of public participation (Li et al., 2012; Enserink and Koppenjan, 2007), but also provided empirical support for the macro-level performance derived from public participation (Enserink and Koppenjan, 2007; Xie et al., 2012). By framing public participation performance in Chinese PCPs as a context-based construct, the survey results revealed that the KPIs, which used to benchmark public participation in Chinese PCPs, should require a balanced view using six most important KPIs at both levels. They are KPI1 "improve the democracy of decision making for a better governmental governance mechanism" (4.28), KPI8 "prevent and mitigate negative environmental impacts on local residents (4.25), KPI4 "improve the public's confidence on administration abilities of the government" (4.22), KPI5 "improve local infrastructure for international identity and reputation of the city" (3.99), KPI2 "provide more job opportunities and promote sustainable economic development in the region" (3.96), and KPI3 "Improve the social harmony and stability of project developments" (3.96).

This study also made a significant contribution to practice by developing a practical index, namely, PPPI. Recognizing that only a few studies have developed a pragmatic performance evaluation index to improve the implementation of public participation in the Chinese PCPs, developing a PPPI that serves as a benchmark for measuring participation performance in PCPs is important. This index tool can provide strong support for the initiative of China's central government that both public participation and social governance are accepted as key to improving public governance, as emphasized by President Jinping Xi in a recent address (Huang et al., 2016). This index tool can assist clients, contractors, and consultants in determining successful participation in PCPs and in aiding those parties who

are involved in PCPs in assessing, monitoring, and upgrading the prevailing participation performance in their projects.

The findings of this study have a strong implication for other developing countries with similar public participation programs in PCPs, such as Thailand (Manowong and Ogunlana, 2006), Bulgaria (Almer and Koontz, 2004), Bangladesh (Momtaz, 2002), and Turkey (Ogunlana et al., 2001), that face similar situations in implementing public participation. The results of this study provide valuable insights for those countries by providing a holistic undertaking of public participation performance in PCPs of developing countries. Recognizing a number of developing countries have some variations in political, economic and social developments that other developing countries have compared with China, they still can replicate the research methodology proposed in this study to develop their own PPPIs and tailor-fit the benchmarking purposes of local participation practices.

Developing a pragmatic PPPI based on limited empirical data is difficult. This study might still fall short in the sample size. The sample size can be considered as relatively small because the location of the study, the Guangzhou City, has a permanent resident population of over 10 millions. In addition, recognizing that public participation practices in various areas of China have different development levels (Shan and Yai, 2011), the PPPI developed in this study might require further refinements to adjust for PCPs in other regions in China with a different public participation development level.

6. Conclusions

To respond to constant calls from the current President Jinping Xi (Huang et al., 2016) and the

former presidents (i.e. Zeming Jiang, and Jintao Hu) in the country (Jiang, 2002; Hu, 2007), public participation has been increasingly employed in Chinese PCPs over the past decade to achieve environmental and social objectives. However, this mechanism seldom yields satisfactory results, and such problem is only partially addressed in previous studies. By conducting an empirical survey, this study has developed a pragmatic index for benchmarking the performance of participation activities in Chinese PCPs. Six KPIs have been identified from the survey and used to develop the index. A recently completed megaproject, the Guangzhou Asian Games venue construction, was selected as a case study to illustrate the use of the PPPI. The analysis results indicated that the overall participation in the case study is below the acceptable level because of the limited use of participation forms. Given that the megaproject can be regarded as a national demonstration project in economically developed regions of China, the findings from the case study may reflect the actual situation of public participation practices in China to some extent, that is, the progress of this new mechanism remains slow. Therefore, the implementation of this mechanism in PCPs must be improved. The PPPI provides a tool to improve future participation practice. Different participation activities in PCPs can be objectively evaluated as a whole using this index.

The findings of this study can help the scholars and practitioners in the construction sector to better implement participation activities in PCPs. Clients and project managers can use this index to assess, monitor, and improve process performance as well as to manage their participation activities in PCPs. Although this index is specifically developed for China, the research method can be replicated in other countries and regions to develop similar indices. The similarities and differences of these indices can then be compared to advance

the existing knowledge on public participation in the construction sector, particularly in developing countries.

Conflict of interest

There is no conflict of interest.

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References

Almer, H.L. Koontz, T.M. 2004. Public hearings for EIAs in post-communist Bulgaria: do they work? Environmental Impact Assessment Review, 24(5), 473-493.

Andranovich, G., Burbank, M. J., Heying, C. H. 2001. Olympic cities: Lessons learned from mega-event politics. Journal of urban affairs, 23(2), 113-131.

Arnstein, S. 1971. A Ladder of Citizen Participation. *Journal of the American Institute of Planners*, 35(4), 216-224.

Beijing News. (2010). Multiple Chinese cities are surrounded by waste, management inadequacy results in dumping [Chinese version only]. Retrieved 30 August, 2013, from http://ep.chinaluxus.com/Erv/20101101/17969.html.

China International Engineering Consulting Corporation (CIECC). 2004. A Guide to Social Impact Assessment of Investment Projects in China [Chinese version only]. China Planning Press, Beijing, China.

Cheung, C.-K., and Leung, K.-K. 2007. Enhancing life satisfaction by government accountability in China. Social Indicators Research 82(3), 411–432

Chow, L.K. 2005. Incorporating Fuzzy Membership Functions and Gap Analysis Concept into Performance Evaluation of Engineering Consultants – Hong Kong study

(Unpublished PhD thesis), The University of Hong Kong, Hong Kong.
Economist. 2009. The other Moore's law, *The Economist*, Vol.390 No.8618, pp.17.
Enserink, B., Koppenjan, J. 2007. Public participation in China: sustainable urbanization and governance. Management of Environmental Quality: An International Journal, 18(4), 459-474.
Flyvbjerg, B., Bruzelius, N., Rothengatter, W. 2003. Megaprojects and Risk: An Anatomy of Ambition. Cambridge, UK: Cambridge University Press.
Guangzhou Asian Games Organizing Committee. 2010. Official emblem of the 16th Asian Games. China Daily, August 11. Retrieved 15 August 2013, from China Daily website: http://www.chinadaily.com.cn/sports/2010asia/2010-08/11/content_11137391.htm
Hong, Y., Chan, D. W., Chan, A. P.C., Yeung, J. F. 2011. Critical analysis of partnering research trend in construction journals. Journal of management in engineering, 28(2), 82-95.
Hong, T., Li, C., Yan, D. 2015. Updates to the China Design Standard for Energy Efficiency in public buildings. Energy Policy, 87, 187-198.
Horne, J. 2007. The four 'knowns' of sports mega‐events. Leisure studies,26(1), 81-96.
Hu, J.T. 2007. Hold High the Great Banner of Socialism with Chinese Characteristics and Strive for New Victories in Building a Moderately Prosperous Society in All Respects. Report to the 17th National Congress of the Communist Party, Beijing, China, October 15. Retrieved 15 August 2013, from: http://news.xinhuanet.com/english/2007-10/24/content_6938749.htm
Hu, J.T. 2012. Firmly March on the Path of Socialism with Chinese Characteristics and Strive to Complete the Building of a Moderately Prosperous Society in All Respects. Report to the 18th National Congress of the Communist Party, Beijing, China, November 8, Retrieved 25 August 2013, from: http://news.xinhuanet.com/english/special/18cpcnc/2012-11/17/c_131981259.htm.
Hu, Yi, Chan, A. P. C., Le, Y., Xu, Y., Shan, M. 2016. Developing a Program organization performance index for delivering construction megaprojects in China: fuzzy synthetic evaluation analysis. Journal of Management in Engineering, 32(4), 05016007.
Huang, Y.L., 2010. Residents fight maglev line, *China Daily*, 9 August, pp.25.
Huang, Y., Ning , Y., Zhang, T., Fei, Y. 2015. Public acceptance of waste incineration power plants in China. Habitat International, 47, 11-19.
Huang, L., Yu, Y. 2010. Guangzhou Mayor makes an apology to urban citizens on the conveniences caused by the Asian Games construction (only the Chinese version). Yangcheng Evening News, Guangzhou, January 1, A09.
Irvin, R. A., Stansbury, J. 2004. Citizen participation in decision making: Is it worth the effort? Public Administration Review, 64(1), 55-65.
Jiang Z.M. 2002. Build a Well-off Society in an All-Round Way and Create a New Situation in Building Socialism with Chinese Characteristics. Report to the 16th National Congress of the Communist Party, Beijing, China, November 8, retrieved from: http://english.people.com.cn/200211/18/eng20021118_106983.shtml.
Ke, Y., Wang, S., Chan, A. P., Cheung, E. 2009. Research trend of public-private partnership in construction journals. Journal of Construction Engineering and Management, 135(10), 1076-1086.

Kim, S., Schachter, H. L. 2013. Citizen participation in the budget process and local government accountability: Case studies of organizational learning from the United States and South Korea. Public Performance & Management Review, 36(3), 456-471.

Lach, D. Hixson, P. 1996. Developing indicators to measure values and costs of public involvement activities. Interact: The journal of public participation, 2(1), 50-67.

Li, T. H.Y., Ng, S. T., Skitmore, M. 2012. Public participation in infrastructure and construction projects in China: From an EIA-based to a whole-cycle process, Habitat International, 36(1), 47-56.

Li ,T. H.Y., Ng, S. T., Skitmore, M. 2013. Evaluating stakeholder satisfaction during public participation in major infrastructure and construction projects: A fuzzy approach. Automation in Construction, 29, 123-135.

Liu, X. M. 2005. The Audits of Public Engineering Projects [Unpublished Chinese Master Thesis].Capital University of Economics and Business, Beijing, China.

Manowong, E., Ogunlana, S. O. 2006. Public hearings in Thailand's infrastructure projects: effective participations? Engineering, Construction and Architectural Management, 13 (4), 343-363.

Momtaz, S. 2002. Environmental impact assessment in Bangladesh: a critical review. Environmental Monitoring and Assessment, 22(2), 163-79.

Mizrahi, S., Vigoda-Gadot, E., Van Ryzin, G. 2010. Public sector management, trust, performance, and participation: A citizens survey and national assessment in the United States. Public Performance & Management Review, 34(2), 268-312.

Moore, B. (1966), *Social Origins of Dictatorship and Democracy*, Penguin, New York.

Müller, M. 2011. State dirigisme in megaprojects: governing the 2014 Winter Olympics in Sochi. Environment and Planning A, 43(9), 2091-2108.

Newman, J., Barnes, M., Sulliva, H., Andrew, A. 2004. Public Participation and Collaborative Governance. Journal of Social Policy 33(2), 203-223.

Plummer, J., Taylor, J. G. 2004. Community Participation in China: Issues and processes for capacity building, Earthscan, London, England.

Ogunlana, S.O., Yotsinsak, T. Yisa, S. 2001. An assessment of people's satisfaction with the public hearing on the Yadana gas pipeline project. Environmental Monitoring and Assessment, 72(2), 207-225.

Qiu, Q. L. 2009. Guangzhou to ensure better air quality for Asian Games. China Daily, July 13, A03.

Rothstein, B., and Teorell, J. 2008. What Is Quality of Government? A Theory of Impartial Government Institutions. Governance, .21(2), 165-190.

Sanoff, H. 2000. Community Participation Methods in design and Planning, Wiley, New York, NY.

Shambaugh, D. 1996. Containment or engagement of China? Calculating Beijing's responses, *International Security,* 21(2), 180-209.

Shan, C. Yai, T. 2011. Public involvement requirements for infrastructure planning in China, Habitat International, 35(1), 158-166.

Sun, Y., Fang, D., Wang, S., Dai, M., & Lv, X. (2008). Safety risk identification and assessment for Beijing Olympics Venues construction. Journal of Management in Engineering, 24(1), 40-47.

Tan, Y.F. 2010. All 70 Asian Games venues will complete handovers (Only the Chinese version), Nanfang Daily, August 10, A02.

Tam, C.M., Zeng, S.X. and Tong, T.K.L. (2009), Conflict analysis in public participation program of urban planning in Hong Kong, Journal of Urban Planning and Development, 135(2), 51-55.

Thomas, J.C. 1995. Public Participation in Public Decisions: New Skills and Strategies for Public Managers. Jossey-Bass, San Francisco, CA.

Wang, X.H. 2001. Assessing public participation in U.S. Cities. Public Performance & Management Review, 24(4), 322-336.

Wang, Y.H. 2011. Public Participation in Public Policy Making: an empirical study of Participation-based public decisions in Hangzhou City [Only the Chinese version]. Journal of Public Management, 8(3), 24-32.

World Bank. 2013. Social analysis: Glossary of key terms. Retrieved 15 July 2013, from: http://go.worldbank.org/HSXB13LCA0

Xia, B., Chan, A. P. C., Yeung, J. F. Y. 2009. Identification of key competencies of design-builders in the construction market of the People's Republic of China. Journal of Construction Management and Economics, 27 (11), 1141-1152.

Xie, L.L., Yang, Y., Hu, Y., Chan, A.P.C. 2014. Understanding project stakeholders' perceptions of public participation in china's infrastructure and construction projects: social effects, benefits, forms, and barriers. Engineering, Construction and Architectural Management, 21(2), 224–240.

Yang, H., Sui, H.Y. 2012. Guangzhou City's Air quality during the Asian Games period achieved the best level since 2004 (Only the Chinese version), Yangcheng Evening News, December 21, A14.

Yang, H, Yeung, J.F.Y., Chan, A.P.C., Chiang, Y.H., Chan, D.W.M. 2010. A critical review of performance measurement in construction. Journal of Facilities Management, 8(4), 269-284.

Yeung, J. F. Y., Chan, A. P. C., Chan, D. W. M. 2007. Development of a partnering performance index (PPI) for construction projects in Hong Kong: a Delphi study. Construction Management and Economics, 25(12), 1219–1237.

Yeung, J. F. Y., Chan, A. P. C., Chan, D. W. M. 2009. Developing a performance index (PI) for relationship-based construction projects in Australia: a Delphi study. ASCE Journal of Management in Engineering, 25(2), 59-68.

Yin, Y.L., Yan, X.Y. (eds.). 2002. The Management of Public Projects [Chinese version Only]. Nankai University Press, Tianjin, China.

Zhu, Y. Q., Zheng, F.H. 2009. Performance Evaluation in Public Projects [Chinese version Only]. China Economic Publishing House, Beijing, China.

Table 1 Performance indicators identified by previous studies

Type	KPIs	CIEC C (2004)	Li et al. (2012 & 2013)	Liu (2005)	Shan & Yai (2011)	Wang (2001)	Wang (2011)	Xie et al. (2014)	Yin & Yan (2002)	Zhu & Zheng (2009)	Total number of frequency
Macro level	KPI1: Improve the democracy of decision making for a better governmental governance mechanism		√		√	√		√			4
	KPI2: Provide more job opportunities and promote sustainable economic development in the region		√			√				√	3
	KPI3: Improve the social harmony and stability of project developments	√	√		√			√			4
	KPI4: Improve the public's confidence on administration abilities of the government		√			√		√			3
	KPI5: Improve local infrastructure for international identity and reputation of the city		√	√							2
Micro level	KPI6: Improve the profitability of public investments		√						√		2
	KPI7: Improve the acceptance of various social classes on project planning		√		√	√		√			4
	KPI8: Prevent and mitigate negative environmental impacts on local residents (e.g. noise, dust, water pollution, air pollution, and traffic jams)		√							√	2
	KPI9: Facilitate the use of green designs and technologies for energy conservation and emission reduction in building design, construction and operation		√							√	2
	KPI10: Create the harmony of project design with historical, cultural, and natural contexts in the region		√							√	2
	KPI11: Improve project management efficiency during project execution		√				√				2
	KPI12: Enhance cost effectiveness of pubic investments		√	√							2
	KPI13: Reduce potential conflicts for smooth project execution		√	√				√			3
	KPI14: Be adaptive to the changing needs of project development.		√		√		√				3
	KPI15: Improve the safety control in project execution			√							1

Table 2 Profiles of the 192 respondents

Profiles	Categorization	Percentages
Stakeholder role	Government	2%
	Clients	23%
	Designers	3%
	Contractors	57%
	Consultants	3%
	Public	12%
Education	Associate degree or below	13%
	Bachelor degree	83%
	Master degree	3%
	Doctorate degree	1%
Working experience in the construction industry (169 respondents)	1-5 years	13%
	6-10 years	28%
	11-15 years	21%
	15-20 years	19%
	More than 20 years	19%

Note: The sample of working experience in the construction industry only used 169 respondents involved in public construction projects as stakeholders.

Table 3 Rankings of the 15 KPIs in terms of their importance

Code	Mean of weights	Normalized value	Rank	Mean of weights of Contractor Group	Rank	Mean of weights of non-contractor groups	rank	p-value between contractor and non-contractor groups
KPI1	4.28	1.00	1	4.24	1	4.34	1	0.725
KPI8	4.25	0.97	2	4.22	3	4.29	2	0.440
KPI4	4.22	0.93	3	4.23	2	4.21	3	0.719
KPI5	3.99	0.68	4	3.9	6	4.12	4	0.230
KPI2	3.96	0.65	5	3.93	4	4.01	6	0.787
KPI3	3.96	0.65	5	3.92	5	4.02	5	0.704
KPI7	3.85	0.53	7	3.76	9	3.98	7	0.018
KPI9	3.85	0.53	7	3.81	8	3.9	8	0.385
KPI15	3.85	0.53	7	3.82	7	3.89	9	0.578
KPI13	3.69	0.35	10	3.55	10	3.88	10	0.017
KPI12	3.62	0.27	11	3.45	13	3.86	11	0.146
KPI6	3.62	0.27	11	3.51	11	3.77	12	0.409
KPI11	3.59	0.18	13	3.46	12	3.77	12	0.519
KPI10	3.57	0.22	14	3.46	12	3.72	14	0.947
KPI14	3.37	0.00	15	3.28	15	3.49	15	0.337

Table 4 The correlation matrix among the six KPIs

	KPI1	KPI2	KPI3	KPI4	KPI5	KPI8
KPI1	1	0.169[b]	0.398[a]	0.455 [a]	0.304 [a]	0.314 [a]
KPI2		1	0.370[a]	0.222[a]	0.304[a]	0.318[a]
KPI3			1	0.480[a]	0.314[a]	0.383[a]
KPI4				1	0.428 [a]	0.304 [a]
KPI5					1	0.238 [a]
KPI8						1

Notes: a—Correlation is significant at the 0.01 level (2-tailed);

b— Correlation is significant at the 0.05 level (2-tailed).

Table 5 Weights of the six selected KPIs

Code	KPIs	Mean	Normalized value	Rank	Weighting
KPI1	Improve the democracy of decision making for a better governmental governance mechanism	4.28	1	1	0.174
KPI8	Prevent and mitigate negative environmental impacts on local residents (e.g. noise, dust, water pollution, air pollution, and traffic jams) (micro-level)	4.25	0.97	2	0.172
KPI4	Improve the public's confidence on administration abilities of the government (macro-level)	4.22	0.93	3	0.171
KPI5	Improve local infrastructure for international identity and reputation of the city (macro-level)	3.99	0.68	4	0.162
KPI2	Provide more job opportunities and promote sustainable economic development in the region (macro-level)	3.96	0.65	5	0.161
KPI3	Improve the social harmony and stability of project developments (macro-level)	3.96	0.65	5	0.161

Table 6 Results of the survey regarding the case study

Code	KPI	Mean	Rank
KPI8	Prevent and mitigate negative environmental impacts on local residents (e.g. noise, dust, water pollution, air pollution, and traffic jams) (micro-level)	5.67	1
KPI3	Improve the social harmony and stability of project developments (macro-level)	5.11	2
KPI5	Improve local infrastructure for international identity and reputation of the city (macro-level)	4.67	3
KPI4	Improve the public's confidence on administration abilities of the government (macro-level)	4.11	5
KPI1	Improve the democracy of decision making for a better governmental governance mechanism (macro-level)	4.00	4
KPI2	Provide more job opportunities and promote sustainable economic development in the region (macro-level)	2.56	6