
# 中国大型公共项目建设新理念：参与式决策机制及建筑信息模型技术

# NEW CONCEPTS IN DELIVERING LARGE-SCALE PUBLIC BUILDINGS IN CHINA: PARTICIPATORY DECISION-MAKING (PDM) MECHANISM AND BUILDING INFORMATION MODELING (BIM) TECHNIQUE

李弘扬 著


**国家自然科学基金资助项目：**

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**Project:**

Evaluating and Ranking the Sustainability of Design Proposals of Large-Scale Public Buildings Based on PDM Theory and BIM Technique supported by National Natural Science Foundation of China (71501074)

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# 前　言

本专著聚焦中国大型公共项目建设新理念，涵盖参与式决策机制及建筑信息模型技术等。大型公共工程建设规模大，难度高，影响广，期间有效实施参与机制，对于项目决策各方皆有益处。另一方面，建筑信息模型技术可有效提升建设效率，在大型公共工程领域应用如火如荼。

本专著分 6 章，旨在为中国大型公共项目应用参与式决策机制及建筑信息模型技术提供指导建议。第 1 章基于国际视角，探讨公共工程应用参与式决策机制的现状，介绍建筑信息模型技术在工民建领域的发展历程。第 2 章详细阐述参与式决策概念、层次及价值；深度剖析参与技术、模型及评价。第 3 章聚焦大型公共项目领域，分析参与式决策机制的应用障碍，并就其进一步发展提出意见和建议。第 4 章围绕建筑信息模型技术，基于国际视野阐述其发展历史和应用现状。第 5 章从不同利益相关者视角出发，剖析建筑信息模型技术在国内大型公共工程的应用障碍，并就其改善效率提出意见和建议。第 6 章对全书进行归纳总结。

本专著出版得到国家自然科学基金青年科学基金资助（项目名称：大型公共建筑设计方案可持续性评价与比选机制探究——基于 PDM 理念及 BIM 技术，项目批准号：71501074）。

针对本专著的意见和建议，请联系 li.terryhy@yahoo.com，欢迎广大读者不吝赐教，谢谢！

李弘扬

2018 年 3 月 28 日

# Foreword

This book focuses on some new concepts in delivering large-scale public buildings in China i.e. participatory decision-making (PDM) mechanism and building information modeling (BIM) technique. Large-scale public buildings are characterized by large investment commitment, vast complexity (especially in organizational terms), and long-lasting impact. An effective participatory decision-making program can be beneficial to the parties involved in many ways. On the other hand, building information modelling (BIM) technique has been introduced to improve the efficiency of the Chinese construction industry, with strong commitment by the government and mandatory adoption in some localities.

This book comprises 6 chapters aiming to provide recommendations/suggestions for improving the implementation of participatory decision-making (PDM) mechanism and building information modeling (BIM) technique in large-scale public buildings in China. Chapter 1 briefly introduces the application of participatory decision-making (PDM) mechanism in public projects and the development of building information modeling (BIM) technique in the Architectural, Engineering and Construction (AEC) industry from a global point of view. In Chapter 2, the concept, levels and values of participatory decision-making (PDM) as well as its techniques, models and evaluation are illustrated in more details. Chapter 3 focuses on large-scale public buildings and analyzes the barriers using participatory decision-making (PDM) mechanism in project delivery. Chapter 4 discusses, from an international perspective, the history, development and current application of building information modeling (BIM) during the project lifecycle. In Chapter 5, suggestions are provided for improving the implementation of building information modeling (BIM) technique in large-scale public buildings in China from a multi-stakeholder perspective. Chapter 6 concludes the book.

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Comments or suggestions can be sent to li.terryhy@yahoo.com and I would be happy to hear from you.

Li Hongyang
2018/3/28

# 目 录

# Contents

# CHAPTER 1

# INTRODUCTION

## 1.1 Participatory Decision-Making (PDM) in Large-Scale Public Buildings

The concept of participatory decision-making (PDM) is one of growing interest all over the world, especially with the recent global trend toward increased involvement of the public in the process of agenda-setting, decision-making, and policy-forming (Rowe and Frewer, 2004; 2005; Li, 2013). Participatory decision-making (PDM) offers a channel for "*the redistribution of power that enables the have-not citizens ... to be deliberately included in the future*" and requires "*the involvement of individuals and groups that are positively or negatively affected by a proposed intervention (e.g., a project, a program, a plan, a policy)*" (Arnstein, 1969:216; André *et al.*, 2006:1).

Such "*individuals and groups that are positively or negatively affected by a proposed intervention*" are defined as stakeholders. The stakeholder definition originated in the Stanford Research Institute in the 1960s, representing those groups without whose support the organization would cease to exist (Olander, 2007). The concept has gained widespread acceptance since the mid-1980s, after Freeman's (1984:46) book, *Strategic Management: A Stakeholder Approach*, widened the stakeholder definition to include "*any group or individual who can affect, or is affected by, the achievement of the organization's objectives*". Nowadays, references to stakeholders are commonplace both in academic texts and mainstream media and government communications (Friedman and Miles, 2002). The implementation of stakeholder theory has been far extended from its original application in strategic management to a number of fields of enquiry including, more recently, construction project management (Atkin and Skitmore, 2008). For public buildings, the stakeholder groups are more apparent as schemes of this type usually have an impact on the public in general, particularly when social and environmental issues are at stake (Manowong and Ogunlana, 2008). Atkin and Skitmore (2008) believed that successful completion of public projects is dependent on meeting the expectations of stakeholders throughout the project lifecycle (Li, 2013).

The development of any public project, from initiation to hand over of completed construction, can be controversial and may affect the many different, sometimes discrepant, interests involved both positively and negatively. The representatives of these interests are referred to as the project's stakeholders who can influence the

project process and / or final results, whose living environments are positively or negatively affected by the project, and who receive associated direct and indirect benefits and / or losses (Olander, 2007; Li, 2013). These may include: government / project initiators; the general public / end-users; pressure groups such as the non-governmental organizations (NGOs) and mass media; and the project affected group (Li, 2013). It is very important for the project initiators (e.g. government) to convey their plans to and solicit opinions from other stakeholder groups before any public projects commence and right through to the end of the project cycle (Shan and Yai, 2011). Failing to do so has resulted in numerous project failures (Morris and Hough, 1993), primarily because the stakeholder groups have the resources and capability to stop the projects (Atkin and Skitmore, 2008). As a result, many governments world-wide are increasingly encouraging the involvement of interested individuals, groups and organizations in their public projects as a means of improving the openness, transparency and accountability of the decision-making process and help improve the projects' long-term viability and benefits to the community. To achieve this, many government departments in different countries and researchers from all over the world have identified the major stakeholder concerns in public projects (Palerm, 1999; M-NCPPC, 2001; URA, 2001; Lu *et al*., 2002; PD, 2003; 2006; Tanaka, 2005; Wang *et al.*, 2007; CEDD, 2008; Tang *et al*., 2008; Amado *et al*., 2009; Tam *et al*., 2009; WKCDA, 2010a; b).

It is generally accepted by practitioners of different industries that an effective participatory decision-making (PDM) program can be beneficial to both parties involved (i.e. decision makers and public) in many ways: through participation, public can retain some element of control about the decision to be made which may directly or indirectly affect them (Loh and Civic Exchange, 2002); decision makers, on the other hand, can benefit from wider public input when deliberating, deciding and doing (OECD, 2009) and therefore achieve effective governance (Enserink and Koppenjan, 2007). As for the global AEC (Architectural, Engineering and Construction) industry, participatory decision-making (PDM) is more advocated as the interests of different stakeholders (or stakeholder groups) can be systematically captured and built into the finalized scheme (Ng *et al.*, 2012; Li *et al.*, 2012a; Li *et al.*, 2012b; Li, 2013; Li *et al.*, 2013; Ng *et al.*, 2014; Li *et al.*, 2016a; Li. *et al.*, 2016b; Li *et al.*, 2017). This should help to ensure the required public facilities are properly planned, designed, built, operated and demolished to serve the well-being of various parties in a complex society (Woltjer, 2009).

Despite the various advantages of implementing participatory decision-making (PDM) mechanisms in delivering public projects, its development in China is still

very rudimentary and there is a need to make the participatory process more systematic (Li, 2013).

## 1.2 The Building Information Modeling (BIM) Technique

The concept of building information modeling (BIM), or building description systems more precisely, was first developed by Eastman (1976) in the mid-1970s as "*a database capable of describing buildings at a detail allowing design and construction*". The building information modeling (BIM) technique has experienced rapid development and now encompasses three interconnected aspects, i.e. the model product (i.e. a structured dataset describing a building), modeling process (i.e. hardware and software used for creating a building information model), and model application (i.e. collaborative practices, standards, semantics, etc.) (Wong and Fan, 2013; RICS, 2014; Li *et al.*, 2017).

The Chinese AEC (architecture, engineering and construction) industry is one of the biggest and most important markets around the world (Dodge Data & Analytics, 2015). However, its relatively low efficiency and profitability is a well-recognized problem and practitioners are urged to adopt innovative technologies and processes to improve the industry's overall performance. BIM (building information modeling) has been introduced as a concept to uplift the industry's efficiency. Through BIM, building information can be generated, stored, managed, exchanged and shared in an interoperable and reusable manner (Eadie *et al.*, 2013). With overseas experience demonstrating that great benefits can be obtained by the use of BIM in project delivery (e.g. fewer design coordination errors, more energy efficient design solutions, faster cost estimation, reduced production cycle times and lower construction costs) (Cao *et al.*, 2015), BIM is becoming an increasingly popular and a major topic in China (Li *et al.*, 2017).

The development of building information modeling (BIM) technique is unbalanced from a global point of view, with the United States and Scandinavian region (i.e. Norway, Denmark and Finland) standing as the leaders in BIM adoption in especially public projects (Smith, 2014). China, however, is still in the infancy stage and urges for improvement of applying this revolutionary technique (Li *et al.*, 2017).

# CHAPTER 2

# AN OVERVIEW OF PARTICIPATORY DECISION-MAKING (PDM) MECHANISM

## 2.1 The Concept of Participatory Decision-Making

As one of growing interest all over the world, the concept of participatory decision-making emphasizes enhanced participation of the relevant general public in the decision process. Participation is a channel for the redistribution of power that enables the have-not citizens to be deliberately included in the future and requires the involvement of individuals and groups that are positively or negatively affected by a proposed intervention (e.g., a project, a program, a plan, a policy) (Arnstein, 1969; André *et al.*, 2006; Li, 2013).

The key concepts in the participatory decision-making domain are not generally well formulated and these include *engagement*, *involvement*, *participation*, *communication* and *consultation*. While the terms *participation* and *involvement* are used more or less synonymously, there is distinction among *participation*, *communication* and *consultation* in terms of the principal direction of the information flow between decision makers and participants (Figure 2.1) (Rowe and Frewer, 2005). Information flows one way in *public consultation* (from participants to decision makers) and *public communication* (from decision makers to participants). *Public participation*, however, involves information exchange between decision makers and participants. The three concepts (i.e. *participation*, *communication* and *consultation* in combination are referred to as *public engagement* (Rowe and Frewer, 2005; Li, 2013).

| Some Terms | Direction of the Information Flow | |
|---|---|---|
| **Public Consultation**: | Decision Makers ← | Participants |
| **Public Communication:** | Decision Makers → | Participants |
| **Public Participation:** | Decision Makers ↔ | Participants |

**Figure 2.1** *Information Flow in Consultation, Communication and Participation*
*Source: Rowe and Frewer, 2005; Li, 2013*

## 2.2 The Levels of Participatory Decision-Making

The relevant general public may participate in the decision process at a number of different levels, ranging from manipulation through consultation to citizen control, according to the degree to which publics are empowered in determining the end product (Figure 2.2) (Arnstein, 1969).

<table>
<tr><td>Citizen Control</td><td rowspan="2">The publics gain most of or full power during the decision-making process</td><td rowspan="3">Degrees of Citizen Power</td></tr>
<tr><td>Delegated Power</td></tr>
<tr><td>Partnership</td><td>The publics may negotiate with the power-holders during the decision-making process.</td></tr>
<tr><td>Placation</td><td>The publics may advise during the decision-making process but the power-holders retain the right to decide.</td><td rowspan="3">Degrees of Tokenism</td></tr>
<tr><td>Consultation</td><td rowspan="2">The publics may hear or have a voice during the decision-making process but still lack the power to insure their views to be heeded by the power-holders</td></tr>
<tr><td>Informing</td></tr>
<tr><td>Therapy</td><td rowspan="2">The publics have no power during the decision-making process but are only “educated” or “cured” by the power-holders.</td><td rowspan="2">Non-participation</td></tr>
<tr><td>Manipulation</td></tr>
</table>

**Figure 2.2** *A Ladder of Public Participation*
*Source: Arnstein, 1969; Li, 2013*

This ladder of participation can be reinterpreted in the Chinese context comprising notification, attendance, expression, discussion, decision-making and initiative/self-management from the bottom to the top with increased decision-making (Plummer and Taylor, 2004). The public should participate at the right level and it largely depends on the nature of the decision to be reached: for one has the potential to be controversial, public participation should go beyond merely informing or placating the public.

## 2.3 The Values of Participatory Decision-Making

The values of participatory decision-making practice include: (1) the public should have a say in decisions about actions that could affect their lives; (2) participatory decision-making includes the promise that the public's contribution will influence the decision; (3) participatory decision-making promotes sustainable decisions by recognizing and communicating the needs and interests of all participants, including decision makers; (4) participatory decision-making seeks out and facilitates the involvement of those potentially affected by or interested in a decision; (5) participatory decision-making seeks input from participants in designing how they participate; (6) participatory decision-making provides participants with the information they need to participate in a meaningful way; (7) participatory decision-making communicates to participants how their input affected the decision (IAPP, 2007).

## 2.4 The Techniques of Participatory Decision-Making

16 techniques of participatory decision-making are listed in Table 2.1 and their respective advantages and disadvantages discussed. There is hardly one single best technique which would suit various types of public and different project natures, and usually a combination of several is required to promote participatory decision-making (Canter, 1996).

**Table 2.1** *Participatory Decision-Making Techniques: Advantages and Disadvantages*
*Source: Creighton et al., 1998; Li, 2013*

| Participatory Techniques | Description | Advantages | Disadvantages |
|---|---|---|---|
| Interviews | Technique for quickly assessing public sentiment | (i) Interviews can provide important information about the intensity of people's interest in the issue;<br>(ii) Personal relationships can be built through interviews | (i) Poor interviewing can create a negative impression of the individual;<br>(ii) A highly representative result cannot be yielded through interviews |
| Field Offices | Local offices of the decision makers established in the affected community | (i) It is convenient for the residents to interact with the decision makers;<br>(ii) Decision makers gain more insight into local conditions and the needs of the local people | (i) Field offices can be costly to staff and operate;<br>(ii) A mismatch may occur between staff's commitments to the decision makers and to the local public |
| Hotline | An "easy to remember" telephone number that public can call to ask questions or make comments about the issues | (i) It is convenient for the public to participate;<br>(ii) It is a effective way to answer public's questions, record their comments and provide them with information about the public participation activities | (i) Defensive or insensitive comments may lead to a negative reaction from the public;<br>(ii) Staff with insufficient communication skills may not be able to deal with public comments effectively |
| Displays/Exhibits | Technique for informing the broad public of public participation programs, or for gathering comments from the public | (i) It is a effective way to dispense information;<br>(ii) It can be helpful in identifying the interested individuals and groups | (i) It involves a major commitment of staff time;<br>(ii) Can only play the role of dispensing information |