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# Decision-making governance for the Hong Kong-Zhuhai-Macao Bridge in China

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**Abstract** The complexity of the Hong Kong-Zhuhai-Macao Bridge and the political environment of “One country, Two systems” have brought a vital influence on the decision-making recognition, decision-making analysis, and decision-making management related to this cross-border infrastructure mega-project. Based on case study, this study systematically analyzes the complexity of the decision-making related to the Hong Kong-Zhuhai-Macao Bridge, and explains the general principles that were used for its decision-making management. The research examines the decision-making management system of the Hong Kong-Zhuhai-Macao Bridge, its adaptive behavior, and specific coordination mechanism on different decision-making problems in different decision-making stages. This result provides reference for decision-making management system design of cross-border projects.

**Keywords** decision-making governance, Hong Kong-Zhuhai-Macao Bridge, governance mechanism

## 1 Introduction

Decision-making governance is an important issue in major engineering projects. Governance theory was originally developed from policy research in political science. It has outgrown its initial context and been applied in different industries, including the construction sector (Pryke, 2005). As firms in the construction industry are largely project-based organizations, the governance application can be divided into two interrelated dimensions: corporate and project. This study focuses on project governance.

The term “project governance” has been used in various areas in project management contexts (Bekker and Steyn, 2007). Liu and Yetton (2005) stated that the main purpose of project governance is to control projects and achieve business objectives. Müller (2011) argued that the aim of project governance is the consistent and predictable delivery of a project’s planned contribution to the portfolio and to the achievement of corporate strategic objectives within a corporate governance framework. Project governance provides a structure or a framework that articulates the objectives of the project, the means of attaining given objectives, and the means of monitoring performance (Turner, 2009). Recently, project governance is defined as “the framework, functions, and processes that guide project management activities in order to create a unique product, service, or result and meet organizational strategic and operational goals” (Project Management Institute, 2016). Project governance, as one of the management structures, provides a clear link between a project’s output and an organization’s business strategy (Too and Weaver, 2014).

Project governance is primarily concerned with aligning project objectives with an overarching organizational strategy; it is necessary to trade off the stakeholder benefits across different organizational levels. Projects are embedded across multiple organizational contexts (Sydow et al., 2004). Hence, to achieve organizational

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and project objectives, conceptualizations of project governance need to take into account this multi-level nature, which occurs at the intersections of projects, programs, and project portfolios.

However, the range of governance options open to any firm is limited by the institutional context within which it trades (Winch, 2001). This limitation has given rise to a discussion of embedding organizational and environmental elements in a contracting relation when selecting project governance forms. In construction projects, Reve and Levitt (1984) defined a principal-agent relationship as a professional relationship between the client and the third party consultant to manage construction work taken by contractors. This principal-agent relationship was regarded by Turner and Müller (2004) as crucial in forming an effective governance structure. Control, flexibility, and trust are three basic mechanisms that can be built into the project governance design to eliminate uncertainty and complexity in both organizational and environmental contexts (Osipova and Eriksson, 2013).

The study of decision-making or theory of decision is relatively new. It was in World War II when several areas, like operational investigation, statistical analysis, and programming, emerged as decision support. The contribution of psychology and sociology only surfaced many years later, rendering the decision-making process much clearer (Harrison, 1995). The decision is the moment, in a continuous process of evaluating the alternatives to reach a given goal, in which the expectations on a course of action guide the decider toward this line of thought to reach the main goal. This study aims to develop a decision-making governance framework, based on combining governance theory with decision-making theory in infrastructure mega-projects.

## 2 Research methodology

A case study method was adopted for this research owing to its theory-building nature (Yin, 2013). Applying a case study method is also a response to the research needs proposed by Söderlund (2004). In examining the state of project management research, Söderlund (2004) suggested that the field lacks in-depth case studies, studies of processes, and studies in real time that would be beneficial in building theories for understanding fundamental issues in projects and project organizations. In recent years, governance theory has been adopted into construction practice for managing large infrastructure projects. It is important to investigate contemporary projects in detail to achieve a better understanding of how different governance is in major engineering projects. Case studies allow in-depth, multi-faceted explorations of complex issues in their real-life settings (Crowe et al., 2011) and facilitate the development of theory and interventions (Baxter and Jack, 2008). The case study approach enables examination of the

complex behaviors of, and relationships among actors and agencies, as well as how those relationships influence change.

A case study is generally conceived as an attempt to understand and interpret spatially and temporally bound events. With the shift of political science toward a more theoretical orientation in the last three decades, qualitative methodologists began to think of a case as an instance of something else: a theoretically defined class of events. They were willing to leave the explanation of individual historical episodes to historians, and to focus instead on how case studies might contribute to the construction and validation of theoretical propositions. To this end, George (1979) argued that case study researchers should adapt the method of the historian but convert descriptive explanations of particular outcomes to analytic explanations based on variables. George and Bennett (2005) built on such conceptualization and defined a case as “an instance of a class of events,” and a case study as “the detailed examination of an aspect of a historical episode to develop or test historical explanations that may be generalizable to other events.”

The case of the Hong Kong-Zhuhai-Macao Bridge was selected for this study. Data were collected through semi-structured interviews and document analysis. The Hong Kong-Zhuhai-Macao Bridge is one of the biggest infrastructure mega-projects in China in recent decades, together with the Three Gorges Project, Qinghai-Tibet Railway, South-to-North Water Diversion, West-East Gas Pipeline, and Beijing-Shanghai High-Speed Railway. The Hong Kong-Zhuhai-Macao Bridge was confronted with many important decision-making issues during the construction period, such as bridge location and landing decision, port mode decision, and *Sousa chinensis* protection decision. Given the special political, social, geographical, and natural environment of the Hong Kong-Zhuhai-Macao Bridge, a series of complicated issues were brought by the bridge construction. In particular, the Hong Kong-Zhuhai-Macao Bridge was a cross-border project covering Guangdong province, Hong Kong, and Macao under the political and legal environment of “One country, Two systems.” Therefore, the complexity of the mega-project is mainly derived from the political attribute of “One country, Two systems” and the project attribute of its scale as a “mega project” (Zhang, 2017; Zhang and Sheng, 2014).

“One country, Two systems” is a unique political system put forward according to the history and current situations of Hong Kong and Macao. It refers to the premise of one China, in which Hong Kong and Macao retain their capitalist system as special administrative regions. Compared with the governments in Guangdong province, Hong Kong and Macao have different administrative approval rules and procedures on the establishment, investment, and financing of the bridge project. They likewise have considerable differences in goals, processes, and values

in the decision-making process. In this way, the increase in different interfaces between each party is inevitable, as well as the difficulty of forming decision-making consensus. There are differences in laws related to the establishment, investment, and financing of infrastructure mega-projects, to which the governments separately refer, in governments' administrative rules and procedures, and in the regulations that directly related to infrastructure mega-project management, such as the management of construction contractors' qualities. In Hong Kong, the government implements credit management. The governments in the three places also differ in technical specifications and standards in the engineering and construction fields. For example, Chinese mainland usually has relatively complete technical norms and standards for the design and construction of roads and bridges, whereas the Hong Kong government often refers to previous similar project experiences in accordance with the project features before deciding on the relevant project technical standards in specific practice. The Hong Kong government mainly refers to *Road Engineering Regulations* and *Regulations on the Protection of the Engineering Environment*. Meanwhile, in Macao, project design is conducted in accordance with Portuguese technical specifications, and project construction of public works is mainly in accordance with the Contract for Work on Public Project Construction (regulation 74/99/M). Therefore, the Hong Kong-Zhuhai-Macao Bridge lacked common legal environment and legal authorities during the design and construction period. Meanwhile, the governments in Guangdong province, Hong Kong, and Macao lacked an administrative cooperation and negotiation mechanism for the decision-making of successful mega construction projects (Zhu et al., 2018).

The Hong Kong-Zhuhai-Macao Bridge spans about 35.6 km in total. It adopted a scheme that combines bridge and tunnels. A tunnel scheme was adopted through Tonggu and Lingdingxi Channel, extending to about 6.7 km. Other sections of the bridge extend about 22.9 km, adopting the bridge scheme. The Hong Kong-Zhuhai-Macao Bridge was designed to serve for 120 years. Project construction was confronted with a series of technical innovations, strategic equipment research and development, and other requirements. In this case, decision-makers faced many uncertainties. The evolution of decision-making in large-scale space-time brought challenges to the allocation of decision-making rights between the different decision-makers.

Therefore, it was difficult to implement the decision-making issues, decision-making subjects, and decision-making coordination that confronted the Hong Kong-Zhuhai-Macao Bridge, from the traditional decision-making management practice. The types of decision-making issues, proper arrangement among decision-makers, and structure of relationship among decision-

makers from a higher management level thus needed to be analyzed. The joint action mechanism among the different decision-makers likewise needed to be examined, all to ensure the efficiency and effect of the decision-making for the Hong Kong-Zhuhai-Macao Bridge. Therefore, this study focused on the research of decision-making issues, decision-making coordination, and joint-action mechanism.

### 3 Fundamental principles of decision-making management of the Hong Kong-Zhuhai-Macao Bridge

According to the Commission on Global Governance of the United Nations (Oxford University Press, 1995), "governance" refers to the sum of various methods that are used by public or private individuals and institutions to manage their public affairs. It also refers to a continuous process during which conflicts and different benefits are reconciled and joint actions taken. It includes not only the formal systems and rules that compel people to obey but also various informal institutional arrangements with which people agree or their interests align. Kooiman and van Vliet (2000) argued that the structure or order created by governance cannot be imposed by external forces; relevant social norms and rules should be created and strengthened by different stakeholders.

The goal of engineering decision-making management is to guarantee the quality of decision-making through structure and mechanism design. On the one hand, it aims to form stakeholders' decision-making capability to ensure scientific decision-making. On the other hand, it also aims to ensure the democracy of decision-making through process and rule design, and to allocate rights among government, investors, project managers, and the public. The Hong Kong-Zhuhai-Macao Bridge, a cross-border project, involved many governments, which decision-making principles included several aspects as follows:

(1) Classification principles for decision-making issues. Given the cross-border engineering characteristics, some decision-making issues are generated; common engineering projects usually do not have these issues, namely, public affairs, technical standards, laws and regulations, and qualification requirements. Different decision-making issues need to be addressed by corresponding decision-making stakeholders and processes.

(2) Responsibilities and rights matching principles. Decision-making in cross-border projects involves governments, investment stakeholders, project managers, and the public. According to the different types, decision-making issues usually need to match different administrative powers, authorities, financial rights, and executive rights. For example, governments shall clarify the law, investment models, public affairs, and other administrative decision-

making rights. However, construction project management stakeholders shall have the on-site executive rights of bidding, assessment, and supervision, whereas the public shall have the right to information.

(3) Principles of joint actions. In this cross-border engineering construction, the governments of Guangdong province, Hong Kong and Macao were independent from one another but interrelated because of the project. The case highlights the necessity to establish a mechanism for important decision-makers to exchange conditions during the decision-making process.

#### **4 Deconstruction and reconstruction of decision-making issues in the Hong Kong-Zhuhai-Macao Bridge project**

The Hong Kong-Zhuhai-Macao Bridge project mainly consisted of connective engineering for bridge, island, and tunnel projects. Each project faced the same construction task, including project establishment, scheme demonstration, investment model, construction mode, and construction management. Owing to the differences in laws, regulations, and policy systems between Guangdong, Hong Kong, and Macao, the type diversity of decision-making issues brought by the cross-border characteristic became a challenging problem to solve. System decomposition and reconstruction is an important method to degrade the complexity of complex systems. In addressing the decision-making issues of Hong Kong-Zhuhai-Macao Bridge, the project needed to be deconstructed and reconstructed according to different principles. In the deconstruction systems, the short-term behaviors of each subsystem were irrelevant to the short-term behaviors of the other units. In the long run, however, the behaviors of any unit depended on the behaviors of other units in a general way (Simon, 1962).

First, we deconstruct decision-making issues from the “physical” level. Based on the approximation decomposability principle, the Hong Kong-Zhuhai-Macao Bridge project can be divided into three relatively independent parts. In the three parts, namely, connective engineering units of Hong Kong, Zhuhai, and Macao, such aspects as the laws, technical standards, procedures, investment models, decision-making organizational structures, and rights allocation of the independent project decision-making are decided according to the applicable principles of legal territoriality. Considering the overall function and quality standard of the project, as well as the cross-border characteristics of the construction, the main project of bridge-island-tunnel cannot be divided according to administrative area. Instead, it can only be constructed as an independent project by the three parts, namely, Guangdong, Hong Kong, and Macao.

Second, we deconstruct the decision-making issues from logic; that is, to analyze the major decision-making issues

that occurred in the construction period of the Hong Kong-Zhuhai-Macao Bridge and to classify the decision-making issues. The same type of decision-making issues usually shares commonalities in the decision-making procedure, decision-making subjects, and decision-making coordination mechanism. The types of decision-making issues in the Hong Kong-Zhuhai-Macao Bridge can be divided into the following aspects as shown in Table 1:

##### **(1) Basic legal decisions**

Cross-border engineering projects involve different judicial subjects. These laws and regulations will be specifically embodied in the later establishment stage of project, investment, and financing modes, as well as qualification requirements of bidding and construction boundaries. It will also form constraints and conflicts.

##### **(2) Investment and financing decisions**

As financing plans are influenced and restricted by economic development, financial situations of the cross-border governments, financial benefits of projects, and relevant legal systems in different regions, many investment and financing schemes exist to offer solutions. Therefore, the investment and financing modes of the Hong Kong-Zhuhai-Macao Bridge needed negotiations between the three governments and even coordination from the central government.

##### **(3) Engineering schemes and technical standards**

Given the different technical standards of the three governments in Guangdong, Hong Kong, and Macao, effective mandatory and recommended standards needed to be established on the choices of engineering schemes and technical specifications/standards in the decision-making process.

##### **(4) Public affairs management matters**

Public affairs mainly refer to the administrative jurisdiction of different regions, such as passage rules, entry and exit administration, customs, border defense, public security, inspection, and quarantine. These affairs are restricted by the laws and administrative regulations of different governments and they require coordination principles and mechanisms among the three governments.

##### **(5) Matters of project companies**

Requirements on the engineering construction mode differ by region. For example, in project construction in the mainland, “the legal person of project system” requires that it is a must to have specific “legal persons” who are responsible for the project construction and operation. Based on it, relevant issues of the project legal person’s company (such as law firm, place of registration, investment subjects, and investment proportions) all need negotiation between the different governments.

Finally, reconstructing the decision-making issues of the cross-border project, the Hong Kong-Zhuhai-Macao Bridge, should be through the deconstruction from the physical level and of types of decision-making issues, to determine the valid decision-making matters, decision-making subjects, and decision-making processes.

**Table 1** Deconstruction and reconstruction of the decision-making issues of the Hong Kong-Zhuhai-Macao Bridge at the early stage

	Basic legal decisions	Investment and financing decisions	Engineering schemes and technical standards	Public affairs management matters	Matters of project companies
Main projects of bridge-island-tunnel	Agreements of three governments, jurisdiction	Investment modes, rights, and benefits	Technical standards, bridge schemes, tunnel schemes	Safety, customs, transportation, port and other basic schemes, and implementation schemes	Company's basic schemes, company's organizational structure, basic management systems
Connecting engineering and port engineering in Guangdong, Hong Kong, and Macao	Applicable legal territoriality principles	Various investment and financing modes in Guangdong, Hong Kong, and Macao	Standards respectively applicable to Guangdong, Hong Kong, and Macao	Management modes respectively applicable to projects in Guangdong, Hong Kong, and Macao	Respective jurisdiction of the governments in Guangdong, Hong Kong, and Macao

## 5 Subjective behaviors of decision-making management and management structures related to the Hong Kong-Zhuhai-Macao Bridge

The core of decision-making management emphasizes the regulation and control of the behaviors of all relevant stakeholders at the systemic level. It emphasizes the design of the exercise of governance rights and system arrangement of benefit coordination. The important task is to carry out continuously the coordination at all levels, in all fields, and from all aspects during the process, instead of simply controlling and regulating the behavior changes by certain rigid systems and rules. Therefore, when designing the decision-making management structure of the Hong Kong-Zhuhai-Macao Bridge, an important aspect is to deal properly with the distribution of administrative power, authority, financial rights, and executive rights among different stakeholders. Hufty (2011) pointed out that to solve all kinds of relevant problems in management, it is necessary to deal with the rule of meta-governance, organization standards, and codes of conduct. Here, meta-governance means the rules that determine how the rules of the game are established.

(1) Rules of meta-governance, used to determine the common ideas, values, and objectives of the three governments in Guangdong, Hong Kong, and Macao in the construction period of the Hong Kong-Zhuhai-Macao Bridge. For example, clarify the construction objectives of “establishing world-class cross-sea channels, providing high-quality services for users, and becoming a landmark building,” and establish friendly negotiations, mutual benefits, and applicable principles of legal territoriality among the three governments in Guangdong, Hong Kong, and Macao during the process of construction, operation, maintenance, and management of the Hong Kong-Zhuhai-Macao Bridge.

(2) Organization structure and decision-making issues as closely related. Different decision-making issues are solved by different organization structures. One decision-making issue changes with time and the surrounding

environment. Its corresponding decision-making organizations may change as well.

The principal-agent relationship in the establishment and decision-making process of the Hong Kong-Zhuhai-Macao Bridge must have a dynamic flexibility. As shown in Fig. 1, it is mainly divided into four stages: 1) The national macro-planning stage. The decision-making organizations regarded the National Development and Reform Commission as the core body of decision-making, and formed a principal-agent chain. The State Council authorized the National Development and Reform Commission, and the Hong Kong government and National Development and Reform Commission jointly authorized the Institute of Comprehensive Transportation to conduct demonstration. 2) The project establishment stage. During the stage of engineering feasibility study, the principal-agent chain was reconstructed. In the stage of the initially basic issue demonstration and research, a new principal-agent chain was formed, of which the coordination group in the early stage of the Hong Kong-Zhuhai-Macao Bridge construction became the core body for decision-making. The three governments and relevant departments under the State Council authorized the coordination group that authorized professional institutes to carry out support work for decision-making. 3) The research and approval stages of the project. The three governments and the central government formed a group with special duties. A principal-agent chain was formed, of which the group with special duties authorized the coordination group that in turn authorized professional institutes. The rights of the group with special duties became prominent. The group mainly dealt with decision-making issues related to investments, ports, and public affairs. 4) The Hong Kong-Zhuhai-Macao Bridge Authority with “the nature of public institutes and the operation of companies” was established as the legal person of the project. It was responsible for the construction, operation, and maintenance of the project.

Although the decision-making management organizations were confronted with the same type of decision-making issues, they needed to make adaptive adjustments

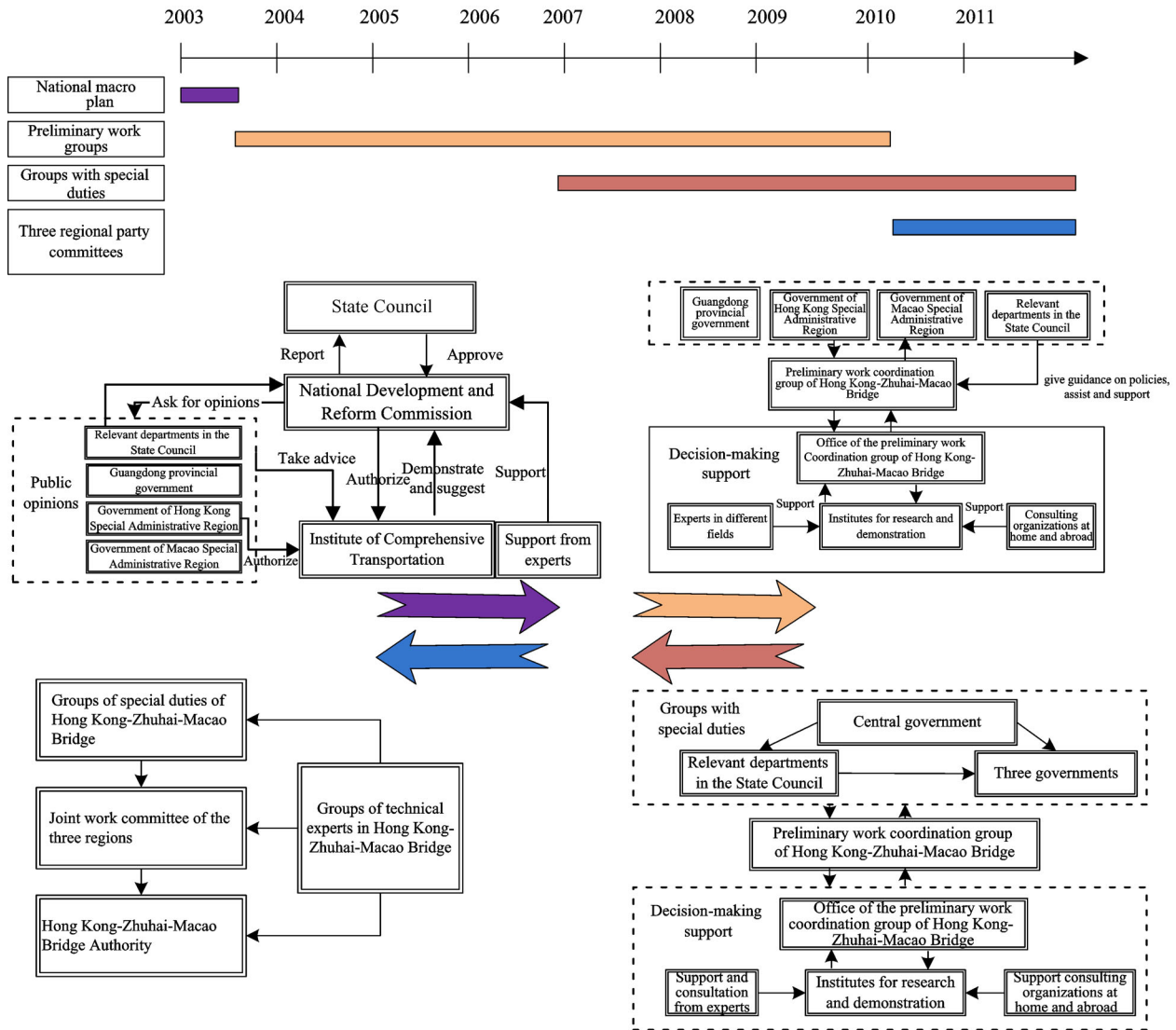


Fig. 1 Diagram of the evolution of decision-making organizations

when different factors, such as technologies, the economy, and society, were involved in different demonstration stages, with the aim of forming the decision-making capability of systems. For example, from the perspective of the landing site and bridge location of the Hong Kong-Zhuhai-Macao Bridge, its decision-making capacity was strengthened gradually. At the convergence stage of the landing site, the decision-making body served as the coordination group for the three governments and CCC Highways Consultants Co., Ltd. However, after determining that the landing site on Hong Kong's side was San Shek Wan of Lantau Island and determining the two combinations of landings sites on Zhuhai and Macao's side, in addition to the decision-making body mentioned above, it also included the National Development and Reform Commission and relevant ministries and commissions of the central government (including the Ministry of

Transport, Ministry of Water Resources, Hong Kong and Macao Affairs Office, Ministry of Environmental Protection, General Armaments Department, and Ministry of Agriculture) when making further comparisons, selection, and demonstrations of the two combinations of landing sites and bridge location schemes.

The decision-making management structure was thus dynamic and flexible. It could greatly realize the matching and connection of the key decision resource elements, such as power, experience, capability, and support, and the decision-making issues that needed to be solved.

(3) Codes of conduct. The main body formation and behavior requirements of different management structure levels need to be clarified. For instance, the group with special duties in the Hong Kong-Zhuhai-Macao Bridge project was composed of the Ministry of Transport, Hong Kong and Macao Affairs Office of the State Council,

Guangdong provincial government, government of Hong Kong Special Administrative Region, and government of Macao Special Administrative Region, under the leadership of the National Development and Reform Commission. The special duties group was mainly responsible for coordinating the decision proposals and significant decision-making issues submitted by the preliminary work coordination group of the Hong Kong-Zhuhai-Macao Bridge, along with other issues from the central government, and for solving the controversial major problems related to the central authority and three governments in the pre-work process of the bridge project. According to the Agreement on the Construction, Operation, Maintenance and Management of Hong Kong-Zhuhai-Macao Bridge between the Three Governments (or Agreements between the Three Governments), the three regional party committees should take responsibilities related to the major decision-making affairs of the project, coordinate the public affairs related to the project, supervise the legal person of the project's main part, and appoint key leaders. The Hong Kong-Zhuhai-Macao Bridge Authority was responsible for the construction, operation, maintenance, and management of the main part, as well as the implementation of various decisions of the three regional party committees. It decided on other affairs as well, apart from the decision-making power of the three regional party committees, in accordance with the Charter of the administration of the Hong Kong-Zhuhai-Macao Bridge.

Therefore, a multi-level decision-making management structure of “three-tier and two-level coordination mechanism” was established according to the expertise of

decision-making affairs, power allocation needed, and attribution of solutions in the decision-making process for the Hong Kong-Zhuhai-Macao Bridge. The specific management structure and stakeholders' behaviors are shown in Table 2.

## 6 Joint action mechanism of decision-making management of the Hong Kong-Zhuhai-Macao Bridge

The Hong Kong-Zhuhai-Macao Bridge was jointly built by the governments of Guangdong, Hong Kong, and Macao. Although the three governments had a common vision and common project objectives, they nonetheless had difficulties in reach an agreement on decision-making stakeholders in the short-term owing to differences in law, culture, and values. This situation tended to compel the decision-making stakeholders to adopt more flexible means of consultation and negotiation to establish joint action mechanisms. Heide and John (1990) noted that joint action is a response to friendly relationships between organizations, emphasizing that different stakeholders are able to work together for a common focus. Joint action consists of a set of decision-making process mechanisms to determine the exchange conditions among members, and its contents comprise joint plans and joint problem-solving.

The joint action of the Hong Kong-Zhuhai-Macao Bridge decision-making management was mainly based on the principle of “friendly relationships” and “negotia-

**Table 2** Multi-level decision-making management structure of “Three-tier and Two-level Coordination Mechanism” of the Hong Kong-Zhuhai-Macao Bridge

	Groups of special duties	Coordination mechanism	Joint work committee of the three regions	Coordination mechanism	Hong Kong-Zhuhai-Macao Bridge Authority
Composition of the main body	Led by the National Development and Reform Commission and represented by the Ministry of Transport, Hong Kong and Macao Affairs Office of the State Council, the governments of Guangdong, Hong Kong and Macao	The three regional party committees respectively report to the three governments; groups of special duties are responsible for clarifying solutions to disputes	The three regional Party committees are made up of nine committee members. The three governments of Guangdong, Hong Kong, and Macao each appoints three members.	Establish a classification and rating decision-making mechanism	The administration director and the three governments respectively appoint a vice director, a chief engineer, and a director assistant.
Decision-making issues	Legal issues, public management, investment and financing affairs, and settlement of disputes		Decision-making and negotiation of project schemes and technical standards, public management, economy and financing, and project companies		Responsible for the decision-making issues of the Hong Kong-Zhuhai-Macao Bridge project during the construction period
Decision-making means	Government decisions		Consultation and negotiation		Public institutes and operation of companies

tion and agreement.” Despite differences in the calculation method and technical parameters of the engineering design of the Hong Kong-Zhuhai-Macao Bridge, the three governments put forward principles of “obedience to high standards instead of low standards” through friendly negotiation, which realized the consistency of the engineering technical standards; as for the different opinions on the bridge location, landing site, and project investment proportions, which were formed from the benefits of different governments, they made certain compromises and finally achieved an agreement on the overall situation. On the basis of obedience to the principles of “exit and entry legal systems in one country” and “regional jurisdiction between ports,” the three governments agreed on the mode of the bridge port.

In the decision-making process for the Hong Kong-Zhuhai-Macao Bridge, agreements on most decision-making affairs were made through negotiation of the “three regional Party committees.” However, reaching an “agreement” on some decision-making issues can be difficult through “negotiation.” In this situation, other methods may be needed to resolve disputes. For example, legal measures or the superior government and other authorities can be sought for arbitration. Agreements of Three Governments on the Hong Kong-Zhuhai-Macao Bridge explicitly states that “if the three regional party committees cannot reach an agreement, the chief representatives of all parties shall report to the superior government respectively. The three governments shall conduct a friendly negotiation on the disagreements or disputes; if the three governments cannot reach an agreement, any government shall report the disputes to the group of special duties of Hong Kong-Zhuhai-Macao Bridge for the decision. No proceedings shall be initiated between the three governments, or between the legal persons of the project and any other government in any region.” This provision fully illustrates that in the decision-making process for the Hong Kong-Zhuhai-Macao Bridge

project, standards of political behaviors among governments are an innovative example in which the three governments are obedient to the “One country, Two systems” policy and the central government leadership. The project thus made full use of the flexibility strategy to solve disputes.

In summary, the focus of the decision-making management in infrastructure mega-projects is the system interface management. It is suggested to deconstruct and reconstruct the different types of issues from the physical and logical levels, and then establish the structure relationships and power allocation of the stakeholders at different levels. As an important decision-making institute, the “three regional party committees” carried out negotiations to take joint actions in the decision-making process. To solve decision-making disputes, the central group of special duties reinforced coordination within the framework system of “One country, Two systems,” with the aim to avoid lawsuits. The process of decision-making management is shown in the Fig. 2.

## 7 Conclusions

Through systematic analysis, this study presented the complete structure of the decision-making system for the Hong Kong-Zhuhai-Macao Bridge project, and many valuable and new experiences contained therein, including the basic structure of the decision-making management system of the Hong Kong-Zhuhai-Macao Bridge, and the adaptability of the decision-making organizations expressed in different decision-making stages, which target the major decision-making issues of different features. These features include the basic design principles of the multi-level decision-making coordination mechanism of the Hong Kong-Zhuhai-Macao Bridge, the important and necessary roles of the central government and the three governments in the mechanism and under the

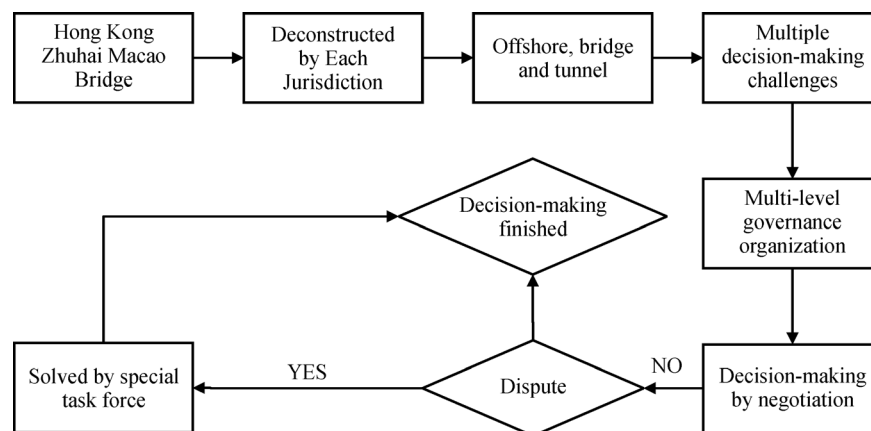


Fig. 2 Process of decision-making governance in the Hong Kong-Zhuhai-Macao Bridge project



decision-making background of “One country, Two systems,” as well as the legal conflicts and coordination mechanism for benefit conflicts among the different stakeholders of the Hong Kong-Zhuhai-Macao Bridge. Meanwhile, the study clearly reflects one of the valuable experiences in the decision-making for the Hong Kong-Zhuhai-Macao Bridge project from many angles. Examples include how to deal with and solve the decision-making issues of cross-border infrastructure mega-projects under the political system of “One country, Two systems”; how to allow effectively the governments to play a leading role in the decision-making process, regulate governments’ decision-making behaviors, and prevent inappropriate interference and excessive discretion right at the same time, through scientific designs of a decision-making mechanism; how to ensure that the optimal resource allocation of market economy systems can play its full role in the framework system determined by governments, according to the dual function of “government-market”; how to use a variety of scientific tools, means, and methods to realize the scientific realization and process norms of mega construction decision-making on an open and democratic decision-making platform.

The following lessons can be drawn from this case study. First, decision-making issues of cross-boarder projects can be divided into five aspects: basic legal decisions, investment and financing decisions, engineering schemes, public affairs management matters, and matters of project companies. Second, the appropriate organization should be established to deal with different decision-making issues, so that the decision-making power and capacity will not be missing, and redundancy, as well as behavior alienation, can be avoided. Third, a joint-action mechanism needs to be established to solve disputes among multiple stakeholders. However, the generality of the proposed decision-making governance paradigm needs to be proved by applying it in other infrastructure mega-projects, which is a direction of our future research.

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## References

- Baxter P, Jack S (2008). Qualitative case study methodology: Study design and implementation for novice researchers. *Qualitative Report*, 13(4): 544–559
- Bekker M C, Steyn H (2007). Defining ‘project governance’ for large capital projects. In: *Proceedings of IEEE Africon 2007 Conference*. Windhoek: IEEE, 20: 1–13
- Crowe S, Cresswell K, Robertson A, Huby G, Avery A, Sheikh A (2011). The case study approach. *BMC Medical Research Methodology*, 11(1): 100
- George A L (1979). *Diplomacy: New Approaches in Theory, History, and Policy*. New York: Free Press
- George A L, Bennett A (2005). *Case Studies and Theory Development in the Social Sciences*. Boston: MIT Press
- Harrison E F (1995). *The Managerial Decision-making Process*. Boston: Houghton Mifflin
- Heide J B, John G (1990). Alliances in industrial purchasing: The determinants of joint action in buyer-supplier relationships. *Journal of Marketing Research*, 27(1): 24–36
- Hufty M (2011). *Investigating Policy Processes: The Governance Analytical Framework (GAF)*. Bern: NCCR North-South/Geographica Bernensia
- Kooiman J, van Vliet M (2000). Self-governance as a mode of societal governance. *Public Management*, 2(3): 359–378
- Liu L, Yetton P (2005). The contingent effects of project governance mechanisms on project delivery capability and the level of control-evidence from the construction and IT services industries. In: *Proceedings of Pan-Pacific Business Conference*. Shanghai
- Müller R (2011). *Project Governance*. Abingdon: Taylor & Francis Ltd
- Osipova E, Eriksson P E (2013). Balancing control and flexibility in joint risk management: Lessons learned from two construction projects. *International Journal of Project Management*, 31(3): 391–399
- Oxford University Press (1995). *Our Global Neighborhood: The Report of the Commission on Global Governance*. George Washington
- Journal of International Law and Economics, 3: 754–756
- Project Management Institute (2016). *Governance of Portfolios, Programs, and Projects: A Practice Guide*. Newtown Square: Project Management Institute
- Pryke S D (2005). Towards a social network theory of project governance. *Construction Management and Economics*, 23(9): 927–939
- Reve T, Levitt R E (1984). Organization and governance in construction. *International Journal of Project Management*, 2(1): 17–25
- Simon H A (1962). The architecture of complexity: Hierarchic systems. *Proceedings of the American Philosophical Society*, 106(6): 467–482
- Söderlund J (2004). Building theories of project management: Past research, questions for the future. *International Journal of Project Management*, 22(3): 183–191
- Sydow J, Lindkvist L, DeFillippi R (2004). Project-based organizations, embeddedness and repositories of knowledge. *Organization Studies*, 25(9): 1475–1489
- Too E G, Weaver P (2014). The management of project management: A conceptual framework for project governance. *International Journal of Project Management*, 32(8): 1382–1394
- Turner J R (2009). *The Handbook of Project-based Management: Leading Strategic Change in Organizations*. Columbus: McGraw-Hill Education
- Turner J R, Müller R (2004). Communication and co-operation on projects between the project owner as principal and the project manager as agent. *European Management Journal*, 22(3): 327–336
- Winch G M (2001). Governing the project process: A conceptual framework. *Construction Management and Economics*, 19(8): 799–808
- Yin R K (2013). *Case Study Research: Design and Methods*. Thousand Oaks: Sage Publications

- Zhang J W (2017). The construction management and planning of the main project in the Hong Kong-Zhuhai-Macao Bridge. *China Highway*, (1): 73–75 (in Chinese)
- Zhang J W, Sheng Z H (2014). Study on the relationship of the “government” principal-agent in the decision-making of the major projects: Based on the practice of the Hong Kong-Zhuhai-Macao Bridge project. *Scientific Decision-Making*, (12): 23–34 (in Chinese)
- Zhu Y L, Sheng Z H, Zhang J W (2018). *Hong Kong-Zhuhai-Macao Bridge Decision-making Practice and Decision-making Governance System*. Beijing: China Communications Press Co., Ltd.