

ORGANIZATIONAL CONFIGURATIONS OF TEMPORARY MULTI-ORGANIZATIONS DELIVERING MEGAPROJECTS: INSIGHTS FROM FIVE MEGAPROJECTS IN CHINA

Temporary multi-organizations (TMOs) are individual temporary client organizations that are jointly established and owned by multiple shareholders to undertake the predefined purposes in megaproject delivery. We conduct in-depth analysis of the organizational configurations of TMOs through a multi-case study of five megaprojects in China. We believe establishing a TMO is a multi-factorial decision and propose two types of TMO – integrated and independent – based on distinct motives for their establishment. Different TMO structuring processes of integrated and independent TMOs further give rise to distinctive patterns of TMO configuration. Based on the analysis of TMOs' intra- and inter-organizational configurations, two patterns of organizational configuration – tightly- and loosely-coupled networks – emerge inductively from the data, and we highlight the dynamic nature of TMO configuration. This paper offers guidance to practitioners on designing and structuring TMOs and dealing with intra- and inter-organizational relations.

Keywords: Configuration; intra-organizational; inter-organizational; megaproject; relationships; temporary multi-organization (TMO)

INTRODUCTION

Megaprojects are defined as large-scale, complex projects that cost US\$1 billion or more, take many years to develop and build, involve multiple public and private stakeholders, and have a profound impact on the national economy and society (Flyvbjerg, 2014; Flyvbjerg et al., 2003; Merrow, 2011; Morris & Hough, 1987). In a one-off megaproject, single organization normally cannot fulfil the project's requirements on multiple capabilities and resources due to the large project scale and only multiple organizations collaborating are able to successfully implement such endeavours. Hence, a TMO is often established by multiple shareholders, which acts as the client organization to be responsible for delivering the one-off megaproject by virtue of shareholders' abundant capital, considerable project experience, and outstanding project management capabilities (Cherns & Bryant, 1984; Lu & Yan, 2007). As the temporary client organization of a one-off megaproject, the TMO is responsible for the overall management of the whole project life cycle until the project passes completion acceptance and is handed over to the owner or operator (Che Ibrahim et al., 2020).

As TMOs play a vital role in the complex and large-scale organizational network assembled to deliver megaprojects (Cherns & Bryant, 1984; Green, 1996), it is essential to explore its organizational configuration. However, extant literature

focuses on analysing the TMO as the whole organizational network composed by all the participating organizations throughout the project life cycle but neglect the fact that the TMO can also be regarded as an individual temporary client organization in standalone megaprojects. In addition, little is known about TMOs' organizational configuration, including intra- and inter-organizational networks and how they are established at the front-end and dynamically changing during the delivery process (Denicol et al., 2021). Hence, this research aims to explore the organizational configuration of TMOs established for delivering megaprojects. To achieve this research aim, we decompose it into two objectives: (1) To explore the motives for establishing TMOs and their structuring at the front-end. (2) To illustrate the TMOs' intra- and inter-organizational configuration and reveal TMOs' dynamic nature.

LITERATURE REVIEW ON TMOs

In the construction sector, TMOs are defined as organizations formed by multiple stakeholders and lasting only for the duration of a single project, at the end of which the members separate and may not work together on subsequent projects (Cherns & Bryant, 1984; Lizarralde et al., 2011). Winch (2014) considers TMOs as temporary configurations of permanent organizations from a wide range of industries coming together to achieve a particular outcome, and integrating different kinds of specialist resources such as finance, techniques, experience and managerial capabilities (Jones & Lichtenstein, 2008; Sydow et al., 2004). Project teams from specialist companies work jointly in TMOs through selection procedures dictated by the client's procurement process (Lizarralde et al., 2011).

TMOs must build effective communication between various participating organizations, foster inter-organizational relationships to conduct tasks relating closely to the overall project goal, manage participating organizations with interests in other projects, and cultivate dynamic organizational networks (De Blois et al., 2016; Stringer, 1967). These four characteristics reveal TMOs' multi-organizational and temporary nature (Cherns & Bryant, 1984; Lizarralde et al., 2011). Most previous studies analyse TMOs as networks composed of multiple organizations participating in the delivery process, involving owners, clients, designers, contractors, subcontractors and operators (Bakker et al., 2016; Brookes et al., 2017; De Blois et al., 2011, 2016; Denicol et al., 2021; Gil et al., 2017; Gulati et al., 2012; Lizarralde et al., 2011), whereas little addresses TMOs as focal entities (Davies & Mackenzie, 2014; Sainati et al., 2020). In summary, most research analyses TMOs as organizational systems at the macro level, rather than as individual organizations with dyadic relationships at the meso level.

Megaprojects are programmes composed of heterogeneous projects involving numerous contractors and suppliers, each with their own purpose (Morris et al., 2011; Shenhar & Dvir, 1996). To achieve the common goals of a megaproject, the client must be able to coordinate the various parties and integrate the component parts (Davies & Mackenzie, 2014; Merrow, 2011). Furthermore, because megaprojects are designed to achieve profound outcomes, their delivery is much riskier, more complex and challenging, demanding that client organizations have abundant capital, relevant techniques, project experience and project management capabilities (Denicol et al., 2020). However, some owners lack these resources, or the projects may not be in line with their business operations and investment portfolios (Söderlund & Tell, 2009). Successful delivery of a megaproject often requires the owner to cooperate with multiple sophisticated industrial companies by establishing a TMO as the client

organization (Davies & Mackenzie, 2014). As the TMO plays a significant role in delivering the megaproject, initial establishment of its organizational structure is important to enable successful implementation at later stages.

In many megaprojects, owners (mostly from the public sector) cooperate with competitive specialist firms (mostly from the private sector) by establishing TMOs as capable clients, assembling and integrating shareholders' resources and capabilities (Sainati et al., 2020). We use the term TMO to refer to a capable client organization established by multiple shareholders to deliver a megaproject. It can be regarded as a physical manifestation of cooperation and coalition between several entities. The TMOs in this research are real companies with physical assets (staff, facilities, etc.), but with constrained authorization and limited lifetimes (Brookes et al., 2017). They are multi-organizations characterized by "unavoidably multidisciplinary composition", in which project staff dispatched by multiple organizations contribute specific skills and capabilities in a joint effort to achieve common goals (Cherns & Bryant, 1984).

In the case of London 2012 Olympics, a TMO established by the Olympic Delivery Authority (ODA) and its delivery partner CLM (a temporary joint venture between CH2M Hill, Laing O'Rourke and Mace), that took the role of managing the overall programme (Davies & Mackenzie, 2014). In Crossrail project, Crossrail Limited was a TMO established as a special-purpose delivery organization accountable to the joint project sponsors, responsible for developing and delivering the overall programme, including all its component projects (Dodgson et al., 2015). Denicol et al.'s (2021) analysis of multiple megaprojects in the UK suggests that owners tend to create standalone entities to be responsible for risky megaprojects, aiming to achieve closer cooperation within the coalition assembled for their delivery. However, previous studies have not explored the overall organizational configuration of TMOs in megaprojects in detail. We investigate the intra- and inter-organizational configurations and relationships by analysing five real-life megaproject cases.

RESEARCH METHODOLOGY

This abductive research uses multi-case study, as it makes the theoretical framework more robust, generalizable, and testable than single-case study (Eisenhardt & Graebner, 2007). Following Eisenhardt (1989), we conducted within-case analysis to deal with the "deluge of data" and cross-case analysis to search for patterns. We gained unusual access to five megaprojects in China briefly introduced as below: Case A programme (\$5.91 billion) contains land acquisition, demolition, municipal, landscaping, and house-building projects in Guangdong. ZJH HSR line (\$5.95 billion) is 247.48 km long (designed speed of 350 km/h), connecting 7 HSR stations located in the west of Hunan province. This airport express (\$4.1 billion) is 41.36 km long (160 km/h) which is the fastest urban railway transit line in China. Case D project (\$1.1 billion) mainly includes Ji River water system management, ecological restoration, environmental enhancement, and comprehensive industrial development, located in Tianjin. The 12.1 km-long Dalian Bay Subsea Tunnel (\$2.6 billion) is the first large-scale subsea immersed tube tunnel project in northern China.

In total, 103 megaproject practitioners from the above 5 megaprojects participated in our face-to-face semi-structured interviews lasting around 45 minutes (see Table 1). Data was captured by audio recording and note taking. Interviewees and TMOs stay anonymous, but individual affiliation are still identifiable to illustrate TMOs' organizational configuration. To reduce interviewees' bias (Eisenhardt & Graebner,

2007), we collected data from public (e.g., TMOs' website, news, and trade press) and internal confidential sources (e.g., project contracts, reports, management regulations).

Table 1: List of interviewees from five megaprojects

Case	Megaprojects	Top-level manager	Middle-level manager	Lower-level manager	No. of interviewees	Duration (minutes)
A	Talent Island Programme	5	16	9	30	1238
B	ZJH High-Speed Railway	6	8	7	21	968
C	Beijing Daxing International Airport Express	2	13	4	19	730
D	Jizhou Ecology-Oriented Development Project	4	9	5	18	968
E	Dalian Bay Subsea Tunnel	1	6	8	15	694
	Total	18	52	33	103	4598

Gulati et al.'s (2012) and Gil et al.'s (2017) research on a hybrid meta-organization composed of two "symbiotically related" layers - the core and the periphery - offers us a lens to inductively analyse data. Through two rounds of initial coding and focused coding (Saldaña, 2013), the inductive frame emerged to present TMO's organizational configuration, which involves three dimensions: (1) the internal organizational configurations and relationships within the TMO (intra-organizational), including the vertical/hierarchical and horizontal/departmental composition; (2) the configurations and relationships between the TMO and other major stakeholders (inter-organizational); (3) the dynamic variation of the TMO's organization configuration. All the within-case analysis of the five TMOs' organizational configuration follows this inductive framework and concentrates on the dimensions involved. The motives for establishing TMOs and their structuring process inductively emerged during the coding process. Interview transcriptions was analysed in NVivo 12.

FINDINGS

Structuring TMOs for megaproject delivery at the front-end

Five major motives for establishing TMOs are firstly identified: government's regulations, developing client's long-term project management capabilities, interest alignment, risk sharing and control, and resource integration. Though establishing TMOs for delivering megaprojects seems like a demand for private investors by governments, other motives are more subjective to create advantages for successfully delivering megaprojects. All TMOs are established based on multiple motives, indicating that establishing TMOs is not driven by a single reason or party, but a multi-factor decision. The cross-case comparison reveals the strikingly different motives between case B and others, as the TMO in case B aims to develop and professionalize the client's project management capabilities for delivering a cluster of railway projects, other TMOs are established to achieve synergy, alignment, and integration among project stakeholders, which implies the TMO's partnering degree in Case B is considerably lower than others. Therefore, two types of TMOs are proposed – independent TMO with lower degree of project partnering (Case B) and integrated TMO with higher degree of project partnering (Case A, C, D, E). With the purpose of forming synergy, compared to independent TMOs, integrated TMOs raise the integration level both internally and externally and enables a higher level of proximity and relationship complexity between stakeholders.

We analysed the structuring process of TMOs in the perspective of shareholder and staff selection. In terms of the shareholder selection, the selection process and criteria of the independent TMO is quite different from the integrated TMO. In Case B, the shareholder selection process is led by China State Railway Group (CR), and the criteria of selecting shareholders is just to find the investors with enough funding. In other cases, the shareholder selection criteria are about not only being able to provide abundant funding but owning relevant specialized techniques, experience, and capabilities. As for the staff selection, while the process in Case B is led by CR, it is conducted by the TMOs' shareholders in other cases. But their selection requirement is similar, which is to find experienced and specialized people who are suitable for the project. Based on their working experience and competences, the assigned personnel are charged with different but interrelated division of labour by arranging them into different managerial hierarchies, functional departments and working positions. At this point, the TMO and its organizational configuration is officially formed. Overall, the different degree of project partnering of independent and integrated TMOs largely determines their inter-organizational relationships with other key stakeholders, which is affected by their establishment motives and structuring processes and eventually leads to different patterns of TMOs' organizational configuration.

TMOs' organizational configuration

This research defines the TMO as the capable client organization established by multiple shareholders, including industrial organizations and public institutions, responsible for megaproject delivery. TMOs in the five cases are all registered companies with limited authorization and duration, predefined purposes set by shareholders, and physical assets located where the megaprojects are executed. Based on the definition, we figure out each TMO's organizational configurations, including the TMOs' internal intra-organizational configurations and their inter-organizational relationships with other stakeholders, for further cross-case comparison and pattern exploration. The relationships are highlighted by interviewees and inductively emerge from interview data during the coding process.

Patterns of TMO configuration

The cross-case comparison of the five TMOs' configuration and relationships reveals two patterns of configuration of TMOs in megaprojects: loosely-coupled and tightly-coupled networks. These are based on six major dimensions of TMOs developed from both literatures and data: project-related activities, company ownership distribution, shareholder types, shareholder involvement, stakeholder independency, and interfaces among key stakeholders (see Table 2).

Table 2: Comparison of loosely- and tightly-coupled networks

TMO dimensions	Loosely-coupled networks	Tightly-coupled networks
Project-related activities	Construction management	Project lifecycle management
Ownership distribution	Public	Public and private
Shareholder types	Financial institutions	Infrastructure related companies
Shareholder involvement	Small-scale involvement	Large-scale involvement
Stakeholder independency	High degree	Low degree
Interfaces among key stakeholders	Clear and stable	Vague and volatile

A loosely-coupled network is evident in Case B - ZJH High-Speed Railway. There is a sophisticated supply chain in the railway industry in China and the TMO is only

responsible for one part of it, which has clearly-defined and stable interfaces with other organizations involved in this supply chain. There are about thirty railway construction management companies across the country and each of them works in the same way, responsible for conducting construction management of the railway projects within a certain region, all of which are established by CR. But still, it has a limited duration: “Our company could be dismantled or become an asset management company when there is no railway construction task in this region” (Case B-Officer-Interviewee 21). Due to the huge railway market in China, it is very necessary to have a leading organization and CR is actually “the ultimate owner” of all the railways across the country. In this case, the TMO’s ownership belongs to public organizations, as all the shareholders including CR are from public sectors. In terms of shareholder types, the TMO is primarily owned by financial institutes, rather than megaproject related companies. Therefore, shareholders of the TMO are only responsible for providing funding but not assigning their staff to the TMO or involved in project delivery. In addition, contractors are hired by the TMO through open tendering, but not assigned by shareholders. Considering all these features, in the loosely-coupled network, the independent TMO performs independently in a sophisticated system and has clearly-defined and stable interfaces with other key stakeholders.

The tightly-coupled network pattern is exemplified by other four cases. In this pattern, the TMO is typically responsible for integrating and managing multiple parts or phases of the whole project lifecycle, including financing, investing, construction management, operational management, etc. Shareholders of TMOs are typically from the public and private sector. While the public investor is assigned by the local government, private firms are determined through the open tendering process of the local government or public investor and bring their funding, experience, and capabilities to provide professional one package services. On the one hand, shareholders dispatch their management staff or teams to establish the TMO where they apply professional management methods and capabilities for success project delivery. On the other hand, the TMOs’ shareholders, mostly private ones, assign their specialized design or construction teams to be contractors according to the shareholder agreement, which are under TMO’s management and control after their assignments start. Since TMOs have legal personality, they have the right to invite tenders for other contractors, such as consulting and advertising companies. Under this pattern, the TMO works much more closely with key stakeholders along the delivery process and usually has to modify its arrangements and plans to match the actions of other key stakeholders: “This happens all the time and during the process, we always keep communicating and negotiating with them to reach a consensus between us and then push the program forward” (Case A-Vice general manager-Interviewee 15). There are frequent and strong interactions between the TMO and other key stakeholders due to the vaguely-defined and volatile interfaces: “the shareholder agreement signed at the beginning wasn’t in very detail. It was actually more like a rough framework, which is not detailed enough to guide practice in the future. So, we usually discuss and negotiate with the local government and our shareholders to specify the terms and reach new consensus” (Case E-Director-Interviewee 3). Normally, to facilitate the TMO’s work, the local government organizes a temporary special working group, staffed by personnel from relevant government departments, as a “window of communication and cooperation” and places it on-site to assist and cooperate with the TMO. Based on all the features, the tightly-coupled network enables the close partnering and strong interactions among key stakeholders by pooling their assets (e.g., funding, people, facilities, capabilities) into the integrated TMO.

Although the TMOs' inter-organizational configuration of the two patterns - loosely-coupled and tightly-coupled networks - is strikingly different, their intra-organizational configuration follow a similar template. The simplest and flattest organizational structure with three vertical hierarchies is always built to enhance information transfer and increase management efficiency. All the departments are set around the purpose of successfully delivering the project, which cover every aspect of project delivery. Different types of special working groups, which exist "more temporarily" than TMOs, are always organized to integrate certain resources and capabilities in a "cross-border" form when serious problems need to be solved or important tasks need to be accomplished. In addition to the formal configurations, informal relationships are typically formed within the TMOs.

TMOs' dynamic nature

The cross-case comparison reveals the TMOs' dynamic nature, reflected in the variation of TMOs' intra-organizational configuration along the delivery process. Firstly, to deal with serious problems or important tasks, special working groups are always organized in an ad hoc form across the hierarchies and departments and are dismantled when the problems are solved, or tasks are completed and certain combination of resources and capabilities are no longer required. Secondly, horizontal departments are also dynamically adjusted to achieve a better fit for the actual conditions of the project, such as inappropriate departmental divisions and newly required specializations. For example, in Case E, "We were also responsible for the safety and environmental protection management. Now this part is taken out from our department because the requirements and workload for environmental protection was increased" (Case E-Director-Interviewee 5). The five cases exemplify that during the megaproject delivery process, the TMO's organizational configuration continuously evolves according to the project's dynamic requirements. No matter how a TMO's organizational configuration changes, the principle of dynamic variation always holds true for goal achievement and successful project delivery.

DISCUSSION

TMO's establishment, configuration and dynamic nature

Expanding the extant TMO research traditionally analysing TMO as the large-scale organizational network at the macro-level (Cherns & Bryant, 1984; De Blois et al., 2016; Lizarralde et al., 2011), this multi-case study analyses TMO as a focal entity at the meso-level, defined as an individual temporary client organization that is jointly established and owned by multiple shareholders to undertake the predefined purposes in megaproject delivery. Our terminology of TMO at the meso level is developed and proposed on the basis of the concept of temporary client organization (Davies & Mackenzie, 2014; Denicol et al., 2021) and SPV (Brookes et al., 2017; Sainati et al., 2020) in megaprojects, which brings together two bodies of literature – TMO research and megaproject research – to pave the way for studying megaproject organising. The combination of five megaproject cases provides a perfect opportunity and context to study TMO at both macro-level and meso-level and to add knowledge to project organizing literature, which cannot be realized by most conventional or small projects.

Based on the meta-organization constituted by a flat and porous core and closed periphery (Gil et al., 2017), this research focuses on TMOs' intra- and inter-organizational configurations and relationships and illustrates more elaborated and precise compositions of megaproject organising. Through the cross-case comparison, we further identify two types of TMO – independent TMO and integrated TMO, and

two patterns of TMOs' organizational configuration – loosely-coupled and tightly-coupled networks, thereby responding to Winch's (2014) calling for investigating temporary project organising.

This research revealed the dynamic nature of TMO's configuration inspired by Denicol et al.'s (2021) argument on evolving architecture of megaprojects and Winch's (2014) call for project configuration dynamic. While their research mainly focuses on inter-organizational dynamic, this research regards the TMO as a single entity at the meso-level and explores the TMOs' dynamic nature in the perspective of intra-organizational configuration. We find that the TMO's intra-organizational configuration changes in response to the dynamic requirements of the project. Two forms of TMOs' intra-organizational configuration dynamics are inductively derived from the five cases of megaprojects: special working groups and division adjustments. Our research supplements and completes the discussion about the evolutionary/dynamic nature of megaprojects with the in-depth exploration on the evolving intra-organizational configuration.

Managerial implications

Establishing a TMO as the client organization could bring great advantages to attracting investment and resources, aligning shareholders' interest, creating synergies among key stakeholder, and sharing and controlling risks. The identified motives might be used by megaproject practitioners to establish the most appropriate type of TMO at the beginning, independent or integrated, which is crucial to the megaproject implementation and subsequent performance. The selection process and criteria of the independent and integrated TMO might be the practical guidance for the megaproject practitioners to get prepared for the megaproject delivery. This thorough analysis of TMO's overall organization configuration could enlighten the megaproject practitioners to design the best-suited organizational configuration, whether loosely-coupled or tightly-coupled, which provides a solid foundation for developing capable client organizations and delivering megaproject successfully. We suggest that client organizations should be structured in a flexibly disciplined format to be capable of adjusting their organizational configurations adaptively and timely in response to constantly changing conditions throughout the megaproject delivery process. Overall, this research has substantial practical implications for megaproject practitioners seeking to establish and develop capable and sophisticated client organizations.

CONCLUSIONS

This research studies the TMO as a focal entity and proposes the concept of TMO at the meso level, which refers to an individual temporary client organization that is jointly established and owned by multiple shareholders to undertake the predefined purposes in megaproject delivery. Two types of TMO are proposed – independent TMO with lower degree of project partnering and integrated TMO with higher degree of project partnering, based on the distinct motives for establishing them. We also explore how the TMOs in megaprojects are established at the front-end in the perspective of shareholder and staff selection. Shareholder selection process and criteria are strikingly different between the independent and integrated TMO. In terms of staff selection, though the process is different, but their requirement is quite the same. The huge differences in TMO establishment between the independent and integrated TMO induce the distinct patterns of TMOs' organizational configuration.

Two patterns of TMO configuration are proposed – loosely-coupled and tightly-coupled networks, based on the six major dimensions of the TMO. The loosely-coupled network is a nearly decomposable but sophisticated system, where the independent TMO is less dependent on and has clear and stable interfaces with other key stakeholders. The tightly-coupled network is featured by the close partnering and strong interactions among stakeholders, where the integrated TMO is directly affected by and has vague and volatile interfaces with other key stakeholders. While the inter-organizational configuration relationships are different between the tightly-coupled and loosely-coupled network, the TMO's intra-organizational configuration is of a similar template constituted by the flattest hierarchical structure, the simplest departmental setting, and special working groups. TMO organizational configuration changes and evolves during the megaproject delivery process, which reflects their dynamic nature in two aspects - special working groups and division adjustments. Above insights deepen the theoretical understanding of TMOs in megaprojects and shed lights on guiding practitioners to design and establish TMOs in megaprojects.

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