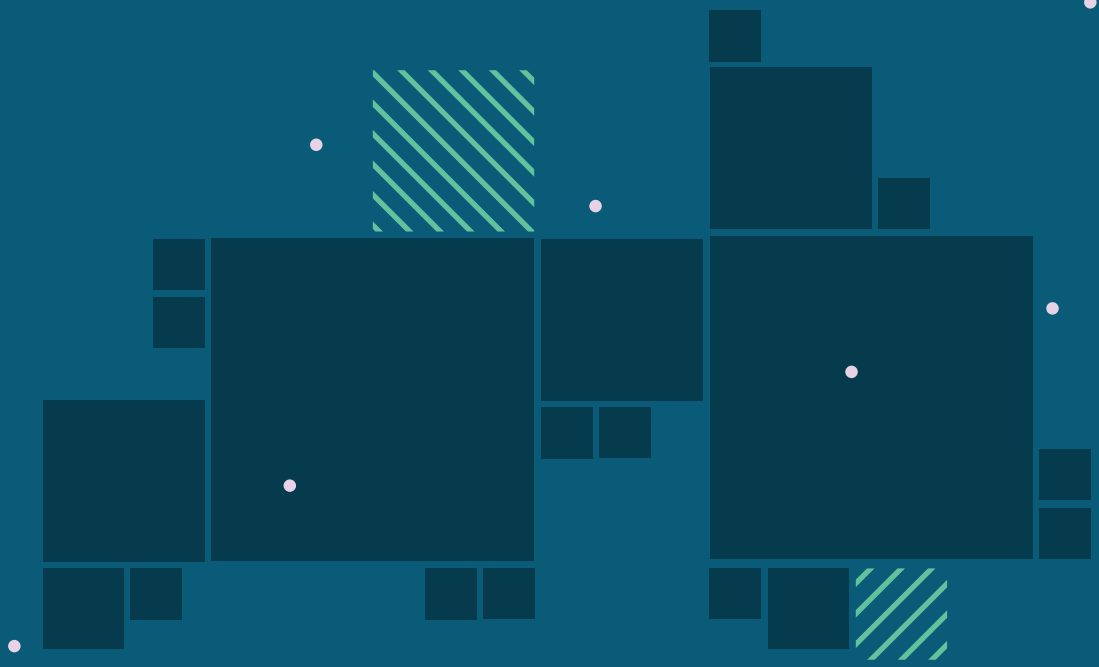
SERIES: Technical Documents on Megaprojects

AN INSTITUTIONAL ECONOMICS APPROACH TO MEGAPROJECT CONSTRUCTION CONTRACTS

Juan Alberti



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Cataloging-in-Publication data provided by the
Inter-American Development Bank
Felipe Herrera Library

Alberti, Juan.
An institutional economics approach to megaproject construction contracts / Juan Alberti.
p. cm. — (IDB Monograph ; 703)
Includes bibliographic references.

1. Construction contracts-Latin America. 2. Infrastructure (Economics)-Latin America. 3. Transportation and state-Latin America. 4. Economic development projects-Latin America. I. Inter-American Development Bank. Transport Division. II. Title. III. Series.

Keywords: Megaproject, Infrastructure, Transport, Planning
JEL codes: D02, D86, H54, O21
IDB-MG-703

This paper was supervised at the Inter-American Development Bank by Andrés Pereyra, Lead Transport Specialist, and Tomás Serebrisky, Principal Economic Advisor, of the Infrastructure and Energy Sector. The author especially acknowledges the contributions and guidance of Prof. Harry Dimitriou and Dr. John Ward, from the OMEGA Centre for Mega Infrastructure and Development, based at the Bartlett School of Planning at University College London.

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TECHNICAL DOCUMENTS ON MEGAPROJECTS

SERIES

This document belongs to a series called “Technical Documents on Megaprojects.” It is part of a significant research effort developed to study megaprojects in the transport sector in Latin America and the Caribbean in 2016, 2017, and 2018. The objective has been to carry out an in-depth analysis of particularly relevant issues concerning the planning, appraisal, and delivery of these endeavors.

For each issue studied, different views proposed by academics and practitioners are illustrated and one position is advocated. It is not the spirit of this series to generate a consistent message around every matter analyzed in the different documents, but to stimulate the discussion and a research environment on this topic. The series can be used as input in those countries that wish to face the challenge involved in developing a megaproject in the transport sector.

PREFACE

This paper shows that there is an opportunity to use an institutional economics approach to the analysis of the challenges around megaproject construction contract development.

It shows, firstly, that this approach is useful to analyze the reasonability of using particular contractual functions and clauses to deal with megaproject complexity. Specifically, although it is here recognized that complexity justifies the use of coordination and adaptation clauses, it is also alleged that safeguarding clauses may or may not be useful as complexity rises because this depends on the relationship between maladaptation costs and transaction costs, both related to the institutional environment.

Secondly, this paper also alleges that new institutional economics is a helpful framework to analyze the prioritization of the underlying factors that determine the criteria used to assess and select contracting methods. This document illustrates that the decision of the procuring method needs to be fundamentally addressed by analyzing the sponsors' characteristics and objectives. This is aligned with the fact that the decision regarding which contracting method to apply should consider the potential minimization of transaction costs, by adjusting governance to the nature of the transaction.

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INTRODUCTION

This paper shows that there is an opportunity to use an institutional economics approach to the analysis of the challenges around megaproject construction contract development. It shows, firstly, that this approach is useful to analyze the reasonability of using particular contractual functions and clauses to deal with project complexity. Secondly, it also alleges that this is a helpful framework to analyze the prioritization of the underlying factors that determine the criteria with which contracting methods are assessed and selected.

With this objective in mind, this paper is organized as follows. Section 2 explains that there are three main contractual functions in construction projects: (i) the safeguard or control function; (ii) the coordination function; and (iii) the adaptation function. Moreover, it explains that these contractual functions are specified via contractual clauses in the context of a particular contracting method. This section succinctly summarizes the different methodologies available for the selection of the contracting method. It shows that, usually, they are ultimately related to underlying factors that can be summarized in: (i) the characteristics and objectives of the owner of the project; (ii) the characteristics of the project itself; and (iii) the external environment.

Section 3, subsequently points out that due to their complexity, megaprojects pose a particular challenge when designing the construction contract. This complexity is three-fold: technical, organizational and environmental. This section shows how complexity alters the selection of the contracting method and how it has an effect on the way the different contractual functions have an impact on performance. Afterward, section 4 introduces the institutional economics approach. It illustrates the generic nature

of contracts and why they cannot be studied separately from their institutional environment.

Finally, section 5 shows how the economic approach to contracts can inform both the relevance of contractual functions and clauses, and the contracting method decision parameters, in the context of megaprojects. For the former, it shows how the reasonability of safeguarding clauses can only be assessed considering the institutional context, on a case-by-case basis. For the latter, it shows that, given the evident complexity imposed by megaprojects, the decision of which contracting method to use is actually related to the characteristics and objectives of the sponsor. This phenomenon can be analyzed by using a transaction cost economizing view, by studying the coherence between the contractual arrangement and the nature of the sponsor.

2

CONSTRUCTION CONTRACTS

2.1. CONTRACTUAL FUNCTIONS

In general terms, a contract may be oral or written, informal or formal. In this paper, following Lyons & Mehta (1997:241), the term contract is reserved to allude to a formal contract, which is understood as a document that describes an agreement in writing and which is perceived, or intended, to be legally binding. Every construction project, and every megaproject as well, which is the focus of this paper, is developed using this kind of formal and written contracts between the different parties involved in the construction process. In general, a contract is a two-party agreement that involves a contractee (i.e., project owner or buyer) and a contractor (i.e., vendor or seller) (Spiller, 2018).

When dealing specifically with complex construction projects, Galo, Chen, Wang, & Wang (2018), explain that there are three contractual functions: safeguard or control function, coordination function, and adaptation function. The development of a megaproject construction contract usually requires the specification of contractual clauses related to each one of these functions. This is true both when contracting is developed between the project owner and the contractor, and when contracts are written for the relationship between the contractor and the subcontractors.

The first function, the safeguarding or control function, is related to the need of each party to ensure that the activities carried out by their counterparts are not pursuing separate and undesired objectives, which may negatively affect property rights. Basically, this contractual function seeks to reduce potential opportunistic behavior.

The intensity of this behavior depends, according to Das & Rahma (2010), on economic, relational and temporal determinants. The first one is related to the specificity of the asset, which can impose information asymmetries. The relational determinants, on the other hand, are related to the cultural differences, and the third ones, the temporary determinants, are linked to the temporal horizon of the exchange, which, if low, can stimulate the mentioned opportunistic behavior. As part of the safeguarding function of the contract, clauses referring to property rights, confidentiality clauses, scope of service and performance guarantee clauses, unilateral termination of the contract clauses and conflict resolution clauses are usually used.

The second function, the coordination function, refers to the need to coordinate interdependent tasks between the different parties, which may have to be carried out separately or jointly (Gulati and Singh, 1998). The contract should specify actions that may not be evident due to the complexity and uncertainty that may exist in the construction project that is being developed (Casciaro, 2003; Dekker, 2004).

The need to use this function is a consequence of the potential complexity of the tasks to be performed in the construction stage. Its aim is to align the expectations between the parties. This function is usually specified by using clauses that establish roles and responsibilities, and also when using reporting clauses, clauses referring to the calendar or program of actions to be developed, and clauses for the appointment of people with particular qualifications in required tasks, among others.

The third and last function, the adaptation function, is related to the need to face the inevitable incompleteness of the contract, due to unforeseen changes in the context. For that purpose, procedures and guidelines that can be specific or generic should be developed, depending on whether an attempt is made to specify (when possible) the different conceivable scenarios, which may carry a cost.

Basically, it is about putting together different contingency plans. This usually requires the presence of contractual clauses, for example, referring to price adjustments, value engineering clauses, clauses with procedures to address unexpected physical conditions and force majeure clauses, among others.

2.2. CONTRACTING METHODS

The need to use the previously mentioned contractual functions and clauses, is intimately related to the contracting method that is selected. The contracting or procuring method of a construction project can be understood as "an organizational system that assigns specific responsibilities and authorities to people and organizations, and defines the relationships of the various elements in the construction of a project" (Love, Skitmore and Earl, 1998, p. 222).

Another good definition is that the contracting method refers to "a mechanism for linking and coordinating members of the building team throughout the building process in a unique systematic structure, both functionally and contractually. Functionally via roles, authority and power, contractually via responsibilities and risks. The main aim is to deliver a project that meets its objectives and fulfill the client criteria and expectations" (Naoum and Egbu, 2015, p. 7).

According to Gordon (1994), the contracting method has four parts: scope, organization, contract and award. The scope refers to the part of the project tasks that are assigned to the contractor, which may include, besides construction, the design and financing as well. The organization is related to the ownership of the contract, which can be developed under a general contractor or a construction manager. The contract refers to the way in which the contractor will be paid and can involve a lump sum or a cost payment plus certain profitability, and can be divided into fixed price or reimbursable contracts. The award is the method used to select the contractor, which may or may not be through competitive bidding (Gordon, 1994). The selected scope, organization, contract, and award affects the reasonability of using specific clauses related to the contractual functions mentioned in the previous section.

According to Naoum and Egbu (2016), the selection of the appropriate contracting method can shape the success of the project (Naoum and Egbu, 2016, p. 309). The traditional method consists of an independent designer, a general contractor, a fixed lump sum contract and a competitive tender. However, several alternative methods have evolved over many years to meet new needs, particularly in complex projects.

Naoum and Egbu (2016, p. 310) explain that new and alternative contracting methods are a response to the following challenges in

construction projects: uncertainty, changing context, change of priorities and expectations, growing complexity of the project, and economic changes (for example, inflation and recession), among others. According to these authors, the criteria of time, cost and quality are too simple in the present, within the framework of a more complex construction project environment. This is an idea that has evolved over time in the literature on construction management.

2.3 SELECTION CRITERIA FOR CONTRACTING METHODS

Regarding contracting methods, the literature associated with construction management has made a relevant effort to determine which are the decision criteria that must be considered when selecting the method, and which is the most suitable method when prioritizing the different criteria. The following paragraphs show an exhaustive list of relevant methodologies that can be used for the selection of the contracting method.

One of the first and most influential reports on this topic was the one developed by the National Economic Development Office of the United Kingdom (NEDO, 1985), called "Thinking About Building", developed in 1985. Its authors produced a table with a decision path and criteria for the owners of the projects to establish priorities.

The criteria were: (i) Time: Is early project completion required?; (ii) Certainty of time: Is project completion on time important?; (iii) Certainty of cost: Is a firm price needed before any commitment to construction is given?; (iv) Price competition: Is the selection of the construction team by price competition important?; (v) Flexibility: Are variations necessary after work has begun on-site?; (vi) Complexity: Does the building need to be highly specialized, technologically-advanced or highly serviced?; (vii) Quality: Is high quality of the project, in terms of material, workmanship and design concept, important?; (viii) Is single-point responsibility to the client, after the briefing stage, desired?; (ix) Is direct professional responsibility to the client from the designers and cost consultants desired?; and (x) Risk: Is the transfer of the risk of cost and time slippage from the client important?

In the context of the development of this work, several authors generated different approaches: rating system, weighted multi-

attribute, eliminatory, analytical hierarchy process, discriminant, rule-based reasoning, case-based reasoning, multivariate, and participatory action research. These approaches are summarized below.

RATING SYSTEM APPROACH – i.e. FRANKS (1984)

This author includes the following performance requirements as criteria to be considered when selecting a specific contractual structure (Franks, 1984, p. 40): (i) technical complexity; (ii) aesthetics; (iii) economy; (iv) certainty of time; (v) size; (vi) certainty of the price; and (vii) facility for change. Based on these criteria, the author developed a table in which points are awarded to the different options according to the ability of each contracting method to cope with the criteria explained. In this regard, he included the following contracting options in his analysis: "traditional", "contracting management" and "design-and-build."

WEIGHTED MULTI-ATTRIBUTE APPROACH – i.e. SINGH (1990)

Singh (1990) proposes a rational procedure for the selection of the contracting method. It is based on the weighting of utility factors that are assigned to different decision criteria, based on the experience of professionals in the construction industry. The weighting depends on the needs of the project and the characteristics of the owner. This author includes the following criteria to be weighed (Singh, 1990, p. 471): (i) Speed; (ii) Certainty; (iii) Flexibility; (iv) Quality level; (v) Complexity; (vi) Risk Avoidance and Responsibility - (vii) Price Competition; and (viii) Disputes and Arbitrations. The different contracting methods that were evaluated in this analysis were: Negotiated Lump Sum; Competitive Lump Sum Negotiated design and build; Competitive design and build; Negotiated Turnkey; Competitive Turnkey; Construction Management; Unit Rate; Cost Plus Fee.

ELIMINATORY APPROACH – i.e. GORDON (1994)

This author explains that the selection of a contracting method is not an exact science and suggests an eliminatory process approach. For said purpose, he proposes a series of steps in the selection

process: (i) Selection of the Organization; (ii) Contract Selection; and (iii) Selection of the Award Method. The criteria that he uses for the selection of the organization are related to: the characteristics of the construction of the project; the analysis of the characteristics of the project owner; and the characteristics of the market. Regarding contract selection, the author suggests considering the existing risks, in particular, the risk of cost overruns. Finally, regarding the selection of the award, the method of adjudication must consider what part of what is contracted is a commodity and what part is a service.

ANALYTICAL HIERARCHY PROCESS – i.e. ALHAZMI AND MCCAFFER (2000)

These authors suggest a selection system consisting of four steps, ruling out the less reasonable options. The first screening is related to what the authors call the feasibility ranking. It is done to analyze the different options, given the characteristics of the project, the attributes of the market, the needs of the contractor, the categories of client, and the local design and construction regulations. The second screening refers to an evaluation by comparison. They compare feasible contracting methods detailing their advantages and disadvantages. The third screening consists of a weighted evaluation. Basically, it seeks to impose objectivity in the analysis. The fourth screening refers to the hierarchical analysis process itself. It consists of four steps: problem hierarchy, pairwise comparisons, construction of overall priorities rating using hierarchical analysis, and evaluation of the consistency of the judgment.

DISCRIMINANT APPROACH - i.e. SKITMORE AND MARSDEN (1988)

The selection approach proposed by these authors is a discriminant analysis, which is a statistical technique used to analyze whether there are significant differences between groups of objects from which certain variables are observed. The authors suggest analyzing whether there are significant differences between the contracting methods, these being the groups of objects, according to data collected on the selection criteria, these being the analysis variables. The selection criteria included in this analysis were: speed, certainty, flexibility, level of quality, complexity, aversion to risk and

competition. In their analysis, they use seven contracting methods: traditional negotiated, traditional competitive, development and competitive construction, competitive design and construction, negotiated design and construction, construction management, turnkey. Based on the statistical analysis on a structured survey of experts where the utility factors are consulted in each case, the authors are able to perform this analysis using, for example, the correlation matrix and the discriminant analysis.

RULE-BASED REASONING APPROACH – i.e BRANDON (1990)

This approach uses again the support of computer systems. The expert systems try to emulate the decision-making process of the experts. It is justified in that it is not possible to generate a traditional mathematical model that captures the internal process that decision makers carry out, which includes imagination, knowledge, and experience. Within the expert systems usually used are those based on previously established rules or RBR (Rule-Based Reasoning). The solution is applying heuristic rules generally supported by fuzzy logic for its evaluation and application. The author used this to analyze the most appropriate method to organize the individual responsibilities of the design and construction teams, in order to ensure that the construction is carried out on time and within the flexibility required by the client. In this regard, it includes five options: (i) conventional (i.e., design, tender, construction); (ii) two-stage tender; (iii) management contract; (iv) construction management; and (v) design and construction. Based on the knowledge provided by a group of experts, they carried out the aforementioned analysis.

CASE-BASED REASONING APPROACH – i.e. LUU, NG AND CHEN (2005)

This approach refers to another type of expert system, based on cases or CBR (Case-Based Reasoning). Basically, in this case, the solution to a previous similar problem is adapted to solve the new problem. The authors allege that the contracting method for a new project can be obtained from similar previous cases in terms of the needs of the clients, project requirements and the characteristics of

the environment. The authors explain that the process from which the decision on contractual structuring is generated imposes two stages. First, the formulation of selection criteria and, second, the selection of the alternative itself. The focus is on the first. The possible decision criteria that they use are the following: (i) speed; (ii) certainty of completion time; (iii) price competition; (iv) certainty in costs; (v) flexibility; (vi) responsibility; (vii) complexity; (viii) assignment of risks; and (ix) quality level. To choose a certain weighting, the authors propose underlying factors that influence this decision: characteristics and objectives of the client; project features; external environment.

MULTIVARIATE APPROACH – i.e. CHAN, HO AND TAM (2001)

These authors do not develop a methodology to evaluate different structuring options for a case. What they propose is to perform a multivariate analysis to explain what are the factors that explain the performance (in cost and time) of a particular contracting method. They explain that there are six factors: (i) project team commitment; (ii) contractor's competencies; (iii) risk and liability assessment; (iv) client's competencies; (v) end-user's needs; and (vi) constraints imposed by end-users. For each project analyzed, the six factors were obtained from surveys to the participating sponsors and contractors.

PARTICIPATORY ACTION RESEARCH APPROACH – i.e. LOVE ET AL. (2012)

These authors explain that the previous methodologies fail to deal with the dynamic nature that exists behind the selection of the contracting method. At the same time, they suggest that the public sector usually avoids using large lists of criteria or complex methodologies for the analysis of this topic. In addition, they believe there are knowledge gaps regarding the different contracting method options, and there is no consensus among experts. These authors recommend adopting a participatory action research approach. This approach is oriented to action and change, with a focus on the problem, through an organic process with systematic but iterative stages, within the framework of collaboration between the interested parties. The suggested steps are the following: (i) identifying project

objectives and constraints; (ii) identifying selection criteria or structuring; (iii) prioritizing criteria; (iv) developing a structure adequacy table; (v) developing a revision session of the contractual structuring; and (vi) recommendation. The authors suggest that the development of this process be in focus group mode, with the participation of several interest groups.

Several of the previous methodologies show that the decision around the prioritization of the criteria to select the contracting method is related to underlying factors related to the characteristics and objectives of the client, project features, and the external environment. A good summary of these underlying factors is proposed by Luu, Ng and Chen (2003):

Client characteristics and objectives:

- Client's experience,
- Client's in-house technical capability;
- Client's willingness to take risks;
- Client's trust towards other parties;
- Client's requirement for on-time project completion;
- Client's requirement for within-budget project completion; and
- Client's requirement for value for money.

Project characteristics:

- Project size;
- Project type;
- Site location;
- Unknown site risk factors;
- Known site factors likely to cause problems; and
- Usage of pioneering technology.

External environment

- Market competitiveness;
- Technology feasibility;
- Regulatory feasibility;
- Availability of materials;
- Experienced contractor availability;

- Labor productivity;
- Inclement weather, natural disasters;
- Objection from local lobby groups;
- Objection from neighbor;
- Political constraints; and
- Cultural differences.

3

MEGAPROJECT CONSTRUCTION CONTRACTS

3.1. MEGAPROJECT COMPLEXITY

One of the most relevant characteristics of megaprojects is their complexity. A complex system is a system formed by several components whose behavior cannot be inferred from the individual behavior of these components (Bar-Yam, 1997). A project can be understood as a complex system when there are multiple structural elements interacting and changing in the progress of its different phases (Whitty and Maylor, 2009).

Bosch-Rekveldt *et al.* (2011) explain that the literature that studies project complexity relates this phenomenon to the uncertainty in goals and methods, to the interdependent interrelation of parts, to softer aspects of the environment, such as politics, to leadership style, and to uncertainty and risk management (Bosch-Rekveldt *et al.*, 2011).

According to Remington and Pollack (2011), megaprojects are typical examples of complex systems. These authors propose a framework with four dimensions of complexity: structural, technical, directional and temporal. The structural dimension is derived from the many interrelated and interdependent activities which generate a form of non-linear feedback between the organizational structures that carry out the project. Technical complexity, on the other hand, is related to the design challenge, and the existence of problems that are more severe than those anticipated. Directional

complexity is the result of unclear or not shared objectives among the participants of the project. Finally, temporal complexity is related to the sensitivity of the project to unpredictable changes in the context, both internal and external, in the time required for its development (Remington and Pollack, 2011).

Borckmann and Girmscheid (2007) also tried to characterize megaproject complexity, and arrived to a three-layered division: complexity of the task, social complexity, and cultural complexity. Task complexity is associated with the density of activities in the spatial and temporal context. Social complexity refers to the number and diversity of the participating actors, who communicate and work with each other. The third one, the cultural one, is tied to the history, experience, and ways of reasoning of the stakeholders involved in the project.

Likewise, De Bruijn and Leijten (2008), explain that megaproject management is basically linked to two characteristics: technical complexity and social complexity. Technical complexity refers to the nature of the project and social complexity to its implementation. Technical complexity is related to the possibilities of generating a robust design using proven technology, the divisibility of the project, the level of association between the different components, and the existence of available options that generate redundancy. Social complexity, on the other hand, comes from the dependence of decision-making on the preferences of users, the high variety and dynamism of these preferences, the blocking power of third parties, the level of social impact of the project and of its implementation time.

In this context, a comprehensive framework is the one proposed by Bosch-Rekveldt *et al.* (2011). These authors present three project complexity dimensions: technical, organizational, and environmental. Technical complexity is related to technological difficulty and the interdependence between project activities. Organizational complexity is the consequence of the hierarchies and differentiation in the teams and actors that participate in the project. Finally, environmental complexity occurs due to the uncertainty in the environment surrounding projects, in terms of the political context, economic conditions, strategic pressure, and interference with the existing site, among others.

3.2. CONTRACTUAL FUNCTIONS AND CONTRACTING METHOD UNDER COMPLEXITY

A megaproject is a complex project considering the dimensions of complexity mentioned above. The contract deals with the three dimensions using control, coordination and adaptation clauses. Furthermore, the dimensions of complexity are intimately related to the underlying factors that many of the authors analyzed in Section 2.2 suggested that should determine the weighting of the criteria with which the opportunity for a specific contractual method should be studied: characteristics of the project, characteristics and objectives of the client; characteristics of the environment.

A good and detailed explanation of the underlying factors is the one proposed by Luu, Ng and Chen (2003), and mentioned above. Regarding the characteristics of the project, megaprojects are vast in size, as measured by their estimated value, and usually present technical difficulties due to the type of construction. There are, in addition, relevant site risk factors in the space where they are developed, and they also involve the use of a specific technology, and have aesthetic requirements.

At the same time, regarding the client's characteristics and objectives, the organizations that are in charge of developing a megaproject may not have enough experience in the construction domain, and may even have a nature that often does not fit the project's own needs. In addition, they usually have little confidence in counterparts.

Finally, on the subject of the external environment, there are usually regulatory gaps and political influence. Furthermore, and in relation to the construction market, there may be no availability of contractors, and therefore the possibility of generating reasonable competition. Sometimes neither technology nor materials are available and that may be a source of conflict.

Considering the previous underlying factors, and therefore the evident complexity, the owners of megaprojects must establish a specific weighting of the following criteria: (i) speed; (ii) certainty of completion time; (iii) price competition; (iv) certainty in costs; (v) flexibility; (vi) responsibility; (vii) complexity; (viii) assignment of risks; and (ix) quality level. This is a difficult task due to the

interdependency of the underlying factors. Moreover, the contracts must fulfill the functions of control, coordination and adaptation consistent with this weighting. The contracting method must include specific contractual clauses that respond to the weighted criteria.

In this regard, the work of Gao *et al.* (2018) is particularly enlightening. They use the framework proposed by Bosch-Rekveldt *et al.* (2011) regarding project complexity, and hypothesize that there is a link between the use of contractual functions and the relationship between the parties to the contract, and that this is related to project complexity. The relationship between the parties of the contract is conceptualized as the satisfaction that one party has regarding the behavior of the other, and their willingness to collaborate in the future. They measure it through the following subjective indicators: (i) satisfaction with this partner's responsiveness to problems in the project; (ii) satisfaction with respect to the other party, when compared with other parties; and (iii) willingness to reoccurring business with the counterpart.

In this regard, the authors propose the following hypotheses (Gao *et al.*, 2018):

1. The positive effect of contractual control on relationship performance is stronger when technical complexity is high than when technical complexity is low.

2. The positive effect of contractual coordination on relationship performance is stronger when technical complexity is high than when technical complexity is low.

3. The positive effect of contractual coordination on relationship performance is stronger when organizational complexity is high than when organizational complexity is low.

4. The positive effect of contractual control on relationship performance is stronger when environmental complexity is high than when environmental complexity is low.

5. The positive effect of contractual coordination on relationship performance is stronger when environmental complexity is high than when environmental complexity is low.

6. The positive effect of contractual adaptation on relationship performance is stronger when environmental complexity is high than when environmental complexity is low.

These authors found that there is a positive impact of the coordination function on governance outcome to deal with every dimension of complexity (hypotheses 2, 3 and 5). This is coherent with the fact that every dimension of complexity increases the interdependence of tasks and the alignment of actions between parties by the contract is called for.

They found, moreover, that contractual adaptation clauses have a positive association with performance when there is more environmental complexity (hypothesis 6). This is again coherent with the fact that environmental complexity may generate more difficulties to imagine every stage of the world and contingency planning is needed.

However, these authors found contradictory results regarding hypotheses 1 and 4, the ones related to safeguarding. They found that there is no association with safeguarding clauses and performance when there is more complexity. Safeguarding on its own cannot mitigate opportunism. The authors attribute this to the weak legal system, but do not make an in-depth exploration of this issue.

It is here alleged that a new institutional economics perspective can be useful to understand this phenomenon. Therefore, Section 4 summarizes this approach and Section 5 uses it to analyze project contracting in the context complexity, in order to make a thorough analysis of the role played by institutions in the context of megaproject construction contracts.

4

THE INSTITUTIONAL ECONOMICS PERSPECTIVE

4.1. NATURE OF THE CONTRACTS

Using an economic perspective, according to Brousseau and Glachant (2002, p. 3) a contract is an "agreement under which two parties make reciprocal commitments in terms of their behavior – a bilateral coordination agreement." According to Ghestin (2002), a contract is "typified" by the exchange of valuables. It is an exchange of benefits rather than an exchange of consents (Ghestin, 2002).

In practice, according to this approach, complex contracts, such as those developed in the case of the construction of megaprojects, are inevitably incomplete. They contain errors and omissions. According to Williamson (2002), this is intimately related to the following characteristics of the participating agents: their capacity for foresight, their limited cognitive ability and their self-interestedness.

Regarding the capacity for foresight, covering all foreseeable contingencies by both parties is usually impossible in a contract due to what the academy related to this issue calls "transaction costs" (Ghestin, 2002). These are the costs involved in writing and executing the contracts. Due to the existence of these costs, the parties can even enter the relationships unspecifying some contingencies, recognizing that if the contingency occurs, it will have to be handled in the following stages, through negotiation and voluntary compliance, or institutionally, by using the judicial power (Klein, 2002).

Regarding limited cognitive ability, to deal with the uncertainty itself, the literature states that the contract plays the fundamental role of providing a basic set of coordination rules, while the institutional framework provides a credibility context of sanctions (Brousseau and Glachant, 2002). Therefore, assuming imperfect institutions, efficient procedures for negotiation, mediation and arbitration must also be included in the contract, in order to deal with this limited cognitive ability (Ghestin, 2002).

Finally, in terms of self-interest, according to Ghestin (2002), to discourage opportunistic behavior when the future is predictable but there are information asymmetries, specific incentives must be included in the contracts. This implies, for example, manipulating the costs of breaking the agreement and increasing the duration of the agreement. In addition, it is also central to use mechanisms for the resolution of private conflicts in order to prepare ex ante bilateral procedures to resolve disagreements when judicial institutions are imperfect (Brousseau and Glachant, 2002).

4.2. CONTRACTS AND INSTITUTIONS

As contracts do not resolve all dimensions ex ante, intentionally or unintentionally, an ex post adjustment is needed. That is why the institutional environment plays an important role (Brousseau, 2008). Therefore, it is here alleged that the contract cannot be studied separately from its institutional environment.

The economic approach to the analysis of contracts here proposed suggests the need for the development of an in-depth institutional analysis. In that regard, new institutional economics is a reasonable theoretical framework for the analysis of the institutional environment (rules of the game - formal and informal) and government institutions (play of the game - the selection of modes of government) (Williamson, 1998).

4.2.1. INSTITUTIONS AS "RULES OF THE GAME"

The "rules of the game" proposed by the NIE approach affect the potential efficiency of the contract as they enable contracting and frame the context to assist in contract enforcement. They can be

formal (judicial, administration, legal system) or informal (culture, traditions and customs) (Brousseau and Glachant, 2002).

Regarding the formal ones, Schwartz (2002) points out that the State should: "enforce contracts; police the contracting process for fraud and duress; supply parties with common vocabularies to use when writing contracts; and supply parties with governance modes for the conduct of transactions or the resolution of disputes" (Schwartz, 2002, p. 116). Imperfect institutions affect contract design. It is due to this imperfection that the parties usually implement private mechanisms to guarantee coordination.

According to Brousseau (2008), a joint analysis between contracts and institutions as rules of the game is, therefore, called for. Without the costs associated with writing and executing the contracts (transaction costs), coordination would be contractual and between the parties and would focus on voluntary compliance or self-imposition. However, since transaction costs always exist, within the framework of the mentioned characteristics of the participating agents, there is a trade-off between relying on formal rules (judicial institutions) or bilateral agreements (private arbitration).

Relying on formal rules or the application of the law generates maladaptive costs. These costs occur if there are potential institutional improvements, if the formal and judicial mechanisms are imperfect. On the other hand, bilateral agreements generate the aforementioned transaction costs. The key is to find the appropriate multilevel governance between contractual and institutional coordination, which depends on the nature of the transaction (Brousseau, 2008).

When using this institutional conceptualization to analyze contracts, which refers to the rules of the game, there are two particularly relevant issues: the institutions that must enforce the contract and the compliance rules. Institutions may have different degrees of specialty and flexibility, changing the way that contracts should be used. Standards, on the other hand, can also be more or less flexible and can be based on principles that may vary, also affecting the way in which the contract is used more efficiently. Therefore, the characteristics of the institutions as rules of the game affect the optimal contractual design, if there is any, which varies according to the ex ante transaction costs and ex post renegotiation costs.

4.2.2. INSTITUTIONS AS "PLAY OF THE GAME"

Williamson (1985) states that if bounded rationality, opportunism, and asset specificity are assumed, then: "transactions should be organized so as to economize bounded rationality while simultaneously safeguarding them against hazards of opportunism" (Williamson, 1985, p. 32).

According to Williamson (2002), considering the transaction as the basic unit of analysis is a useful way to analyze contractual hazards. Basically, if two transactions show different contractual hazards, they must be considered systematically different. Quoting Brousseau (2008, p. 38): "The main problem dealt with by the economics of contracts is the control of hazards induced by the performance of transactions which are caused because the parties exchange promises to give (and receive in exchange) which, most of the time, are not fulfilled simultaneously but at moments when the parties agreed it would be mutually beneficial deal."

The emphasis of the Transaction Cost Theory is therefore placed on understanding the nature of the hazards inherent to different types of transactions. In the case of megaprojects, it is about analyzing the interaction between governments and contractors. To do so, a good framework for analyzing such risks is the one proposed by Spiller (2008).

This author explains that public contracting is exposed to a larger set of hazards than those held between private transactors. The hazard that these two kinds of transactions share is the one related to idiosyncratic investments. Standard opportunistic behavior is related to asset-specific investments, which are linked to bounded rationality and idiosyncratic knowledge. This leads to transaction governance or contract designs in order to limit opportunistic behavior. This is possible, for example, by decreasing information asymmetries.

Governmental opportunism, in the second place, is associated with the ability of governments to opportunistically change the rules of the game. Governments may use standard governmental powers to extract quasi-rents from utility investors. Although the evident determinant is the existence of sunken investments, the limits of governmental opportunism are institutional, generating an impact on the selected regulatory schemes (Spiller, 2013). It may be

profitable if the direct costs (such as reputation loss when asking for new private investment) are smaller than potential benefits (quasi-rents to gain political benefits), and indirect costs are not too large (judiciary/administrative processes) (Spiller, 1996).

The implication of the existence of governmental opportunism is that stronger safeguards will be required to avoid opportunistic interpretations. Moreover, in the context of weak judicial independence or procedural safeguards, this will require upfront rents and public ownership (Spiller, 2008). This behavior will not only be related to the institutions as play of the game, but also as rules of the game, as mentioned in the previous section.

Finally, third-party opportunism is related to public contract scrutiny, considering that the essence of public contracting is its publicity. This type of opportunism may be done by designated agencies, politicians, or other interested groups. The problem is that all of them are biased, and they may be tempted to challenge the probity of the interaction. Both political and economic benefits can be achieved and, given certain complexity, the chance is exploited even if it may be unethical or illegal. Again, the potential for third-party opportunism will depend on the institutional environment, on the rules of the game in the existing governance environment (Spiller, 2013).

Spiller (2013) mentions that this framework is particularly suited to analyze fundamentally, but not exclusively, the utility industries. He differentiates them from other sectors as they present a combination of three features: specific investments; economies of scale and scope; and widespread domestic consumption. Under this view, megaprojects in the transport sector can also be included in the group of investments that are affected by the above-mentioned contractual hazards.

5

CONTRACTUAL FUNCTIONS AND CONTRACTING METHOD IN PERSPECTIVE

5.1. CONTRACTUAL FUNCTIONS IN PERSPECTIVE

This NIE perspective can be used to analyze the different effects of the contractual functions in complex projects, such as megaprojects. In particular, it can be useful to understand why a greater number of clauses associated with the control or safeguard function are not associated with a better relationship between the parties when complexity increases.

According to Spiller (2008), there are three contractual hazards: standard opportunistic behavior, governmental opportunism and third-party opportunism. The contractual function to deal with this is fundamentally the control or safeguard function, which includes clauses to deal with: (i) property rights; (ii) confidentiality; (iii) service scope and performance guarantee; (iv) unilateral early termination; and (v) conflict resolution.

The reasonability of the use of this function is very much related to the institutional background, which is very context specific. In fact, it depends on formal (administration and legal system) and informal (culture, traditions, and customs) rules. They affect the kind of contract needed.

The impact of the control function of the contract is affected by the relationship between maladaptation costs, due to court-enforcement, and transaction costs, due to contract development

or self-enforcement. This is intimately related to the rules of the game (how credible and costly is court-enforcement? Which is the regime for breach remedies? Which are the principles used to interpret the contract? The degree of specialization, etc.), the nature of the transaction itself (asset specificity, pay-off inequity, goal incompatibleness, horizon of the agreement) and the play of the game (the distribution of preferences and information asymmetries between parties). The control function generates, under these conditions, multi-level governance between the contractual and the institutional spheres.

The rules of the game, the nature of the transaction, and the design of governance vary from case to case, and the reasonableness of establishing contractual control or safeguard rules depends on them. That is why in complex projects such as megaprojects, it is not evident that a "better" contract, in terms of relationship performance, is one that includes a greater number of clauses associated with this function. The opposite occurs with coordination and adaptation functions, which are expected to improve the relationship between the parties.

5.2. CONTRACTING METHOD IN PERSPECTIVE

The selection of the contracting method, which includes scope, organization, contract, and award, is a complex process and several construction management academics have developed different methodologies. A good summary of the underlying factors that determine the weighting of the selection criteria is the one proposed by Luu, Ng and Chen (2003), who identify three groups: 1) characteristics and objectives of the client; 2) characteristics of the project; and 3) external environment.

A large number of the parameters mentioned in groups 2 and 3 are in fact a thorough analysis of the complexity of the project. Group 1, on the other hand, is related to the client's characteristics. The NIE perspective can be used, again, to illuminate this decision around the prioritization of these factors. This is indeed a matter of the relationship between the rules of the game and the play of the game.

Firstly, regarding the rules in place, the State needs to provide parties with common vocabularies to use when writing contracts; and provide parties with governance modes for the conduct of

transactions. This is related to the availability of the different procurement method options. Secondly, the play of the game proposed by Williamson (1998), is basically related to proposing a contractual arrangement (contracting method in megaprojects) aligned to the characteristics of the parties (group 1 above) and the nature of the transaction (its complexity – groups 2 and 3 above).

The relevant message by using this perspective's insights is that the adjustment of the contracting method to the different parameters must not be assessed independently. In the case of megaprojects, complexity can be usually assumed, so the contracting method should be aligned to the client's characteristics and objectives.

Luu, Ng and Chen (2003) found that the most relevant variables when deciding the procurement method are usually those related to the client's characteristics and objectives. In particular: the client's requirement of time and within budget completion, the requirement of value for money, the client's experience and its in-house technical capabilities. In summary, the contractual structure should be adjusted to the governance design and the resulting incentive structure.

6

SUMMARY

Megaprojects are characterized by complexity as a result of their technical, organizational and environmental contexts. This complexity has two main effects on megaproject construction contract development.

Firstly, regarding contractual functions, complexity justifies the use of coordination and adaptation clauses. However, safeguarding clauses may or may not be useful as complexity rises. Public contracting faces a set of contractual hazards: standard opportunistic behavior; governmental opportunistic behavior; and third-party opportunistic behavior. Megaproject complexity involves a complicated set of these hazards and the potential benefit in the use of the safeguarding clauses, for dealing with these hazards, is related to the institutional background or "rules of the game." It is here alleged that the reasonability of the use of safeguarding clauses to cope with opportunism is related to the relationship between maladaptation costs and transaction costs.

Secondly, complexity is related to an interdependence of the underlying factors usually used to decide what contracting method is more appropriate, and this poses difficulties to make an organized analysis of the problem at hand. This document illustrates, using an institutional economics approach, that given the evident complexity imposed by megaprojects, the decision of the procuring method needs to be fundamentally addressed by analyzing the sponsors' characteristics and objectives. This is aligned with the fact that the decision regarding which contracting method to apply should consider the potential minimization of transaction costs, by adjusting governance to the nature of the transaction. This is related to "play of the game", associated with the specified institutional economics approach to the problem.

7

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