Contractual Joint Ventures for Megaprojects in Construction

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Abstract

Joint ventures in construction typically take the form of a contract joint venture. They are characterized by an internal joint venture contract and an external contract between the joint venture and the owner of the construction project. As such, they are very different from equity joint ventures. The external contract specifies clearly the goals of the joint venture with regard to cost, time and quality. Megaprojects belong to the most complex human undertakings. Typically their volume is above one billion US dollars. Most of the time, they require the formation of an international construction joint venture (ICJV).

35 interviews with participants of ICJVs form the basis for a case study approach combined with grounded theory. The result of the research is a management model for an ICJV. Of special importance for ICJVs are the following categories: meta-functions (decision making, communication, coordination and learning), basic functions (trust, sense making and commitment) and cultural dimensions based on the research from Hofstede (masculinity, long-term orientation, power distance, uncertainty avoidance and individualism).

The success of an ICJV for a construction mega-project does not so much depend upon certain functionalities in the form of the PIMS study (positive approach) but much more on the alignment and appropriateness of the cognitive maps of the major ICJV members. The conducted interviews allow developing cognitive maps for all categories of the management model and for a procedure to deal with cultural problems. Cognitive maps are not fixed in time; they change as the major actors in ICJVs find new contextual clues.

Keywords: Contractual joint ventures, construction, megaprojects, complexity, management model, cognitive maps

Introduction

Construction is in most countries the single most important sector of the economy. Its contribution in developed countries amounts typically to 5% of GDP when measured in the national accounts using the value added concept. The gross added value was 6.2% of GDP for the 27 states of the EU in 2011 with the rest of manufacturing measuring up to 15.5% (Eurostat 2012). It is around 10% of GDP based on construction investment. The investment concept includes design, materials, equipment and construction but it excludes real estate activities (Hauptverband der deutschen Bauindustrie, 2011). In newly industrialized countries the value is around 14% and in the least developed countries around 12% (Crosthwaite, 2000). Construction matters.
Joint ventures in construction are as omnipresent as coal in Newcastle and this since a long time (Hinze 1993). In Germany there exist standard contracts for vertical and horizontal construction joint ventures. In 2004, the second largest German and the eighth largest international contractor, Bilfinger Berger, organized 17% of its job sites as joint ventures in Germany and 80% internationally (unpublished data). This point is often not reflected in the academic literature. Hergert and Morris (2002) classify JV initiation by industry sector and they do not mention the construction sector. A construction joint venture is characterized by an internal joint venture contract and an external construction contract. They take on the form of a contractual joint venture and are different from joint ventures in other industries that are governed only by an internal contract (equity joint ventures). Joint ventures matter in construction.

Megaprojects are invariably described by using superlatives (the prefix “mega” is already one of them). They are called the “giants” among projects (Grün, 2004) or the “new animal” (Flyvbjerg et al. 2003). While such projects are large, they are not unparalleled in history. Historical examples of megaprojects are the pyramids of Giza or the Suez Canal. Megaprojects are interesting objects of study for two reasons. On the one hand, they are the most complex undertakings not only in construction but in all economic sectors. They extend the boundaries of our knowledge. On the other hand they work like magnifying glasses; they unveil problems that might remain unnoticed on smaller projects. As such, they help us to better understand the mechanics of all types of construction projects. An example of a recent megaproject is the Qatar Integrated Railway Project with a volume of more than 29 billion US$ for the design and construction of a metro and high-speed train network. A list of the top 100 current construction projects in the countries of the Gulf Cooperation Council starts at 93 billion US$ and ends at 4 billion US$ for place 100 (Meed Projects, 2013). Megaprojects are not defined by the monetary project volume despite the numbers given up to now, this is only an indicator. Instead, they are defined by their inherent complexity (Brockmann / Kähkönen 2012). For the realization of such megaprojects the resources of the largest construction companies in the world are not sufficient. Megaprojects are built by joint ventures. For the Qatar Integrated Railway Project 18 joint ventures were prequalified and not one single contractor (Meed, 2012). As the partners typically come from different countries and as construction is their purpose, they form international construction joint ventures (ICJVs). International construction joint ventures formed for the execution of megaprojects matter.

The following chapters will explain the research methodology used, the structure of ICJVs and the management of such ICJVs for the purpose of megaprojects. More details and an enlargement of the topics can be found in Brockmann (2007).
Research methodology

A literature review in the fields of law, business administration and construction management was conducted to understand the structure of ICJVs and the difference between contractual and equity joint ventures. Four different project management plans from ICJVs were also analyzed for the structural arrangements. Some supporting data were requested from construction companies by the means of unstructured interviews.

The management model was developed from half-structured interviews with 35 top-level managers of ICJVs in Bangkok and Taiwan. These managers were answering on the background of their past experience with ICJVs not only in Asia but also on the other four continents. They spoke about lessons learned not only from the present but also from past projects. The form of the interview was a modified ethnographic interview (Spradley, 1979). The approach taken was a case study research (Yin, 2003). For the data evaluation from the interviews grounded theory was employed (Strauss / Corbin, 1997). As such no guiding theories were used for the management model; it was developed from the raw interview data after transcription and then checked for consistency with the existing literature. The connection between a case study approach and grounded theory is explained by Eisenhardt (1989).

Management models can be seen as input/output machines: if one provides the right input, the machine churns out the desired output. This is the assumption of success factor research and has been cause for heated debates in management science. March and Sutton (1997) compare success factor research to the emperor’s new clothes; everybody sees something in it while there is nothing. We agree with their assessment. While there is enough gravity for everybody in the world to get his share (K = mg), this does not hold true for milk and honey.

Instead the management model presents a framework in which to move; using it facilitates success but does not guarantee it. It is set up by cognitive maps that are shared by managers with relevant experience and that have proved successful when dealing with real world problems. The concept of cognitive maps is according to the American Psychological Association based on the assumption that an individual seeks and collects contextual clues, such as environmental relationships, rather than acting as a passive receptor of information needed to achieve a goal. Human beings have well developed cognitive maps that contain spatial information enabling them to orient themselves and find their way in the real world; symbolism and meaning are also contained in such maps. Maps need updating once the world has changed (and it always does). So will the management model need to be adapted.

International Construction Joint Ventures

In the introduction we established ICJVs as the standard organisation form for the construction of megaprojects and therefore we need to define this type of joint venture.
By definition (Mead 1994), international joint ventures (IJVs) in general are characterized by (1) a contract between not less than two companies (partners) who invest in the project; (2) independence of the IJV from the partners; (3) a joint control by the partners; (4) independence of the partners from each other and (4) at least one partner with its headquarters outside the country of the production site (international partner) – and accordingly one partner with its headquarters in this country (local partner). This describes an equity joint venture where the investment of equity is the defining idea (Hennart 1988).

Comparing ICJVs as contractual joint ventures and IJVs as equity joint ventures brings the following results (table. 1): ICJVs are in addition defined by the construction contract between the ICJV and the project owner and they are therefore contractual joint ventures. The construction contract defines scope, cost, time, quality and risk distribution. The construction environment is highly dynamic: construction contracts are incomplete by nature (Bajari et al., 2010) due to the complexity of the projects and the owner has the contractual right to change the specifications at any time without giving reasons (e.g. FIDIC Red Book). Despite this dynamism, ICJVs have a much clearer task at their start compared with equity joint ventures.

<table>
<thead>
<tr>
<th>Feature</th>
<th>IJV</th>
<th>ICJV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Defining element</td>
<td>Equity</td>
<td>Construction contract</td>
</tr>
<tr>
<td>Joint venture form</td>
<td>Equity joint venture</td>
<td>Contractual joint venture</td>
</tr>
<tr>
<td>Joint venture contract</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>External contract</td>
<td>No</td>
<td>Construction contract</td>
</tr>
<tr>
<td>Investment by partners</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Independence of JV</td>
<td>Strong (private limited company)</td>
<td>Weak (special purpose partnership)</td>
</tr>
<tr>
<td>International partner</td>
<td>Minimum one</td>
<td>Minimum one</td>
</tr>
<tr>
<td>Local partner</td>
<td>Minimum one</td>
<td>Minimum one</td>
</tr>
<tr>
<td>Scope</td>
<td>To be developed</td>
<td>Well defined</td>
</tr>
<tr>
<td>Duration</td>
<td>Depends on success</td>
<td>Defined by construction contract</td>
</tr>
<tr>
<td>Quality</td>
<td>To be developed</td>
<td>Defined by construction contract</td>
</tr>
<tr>
<td>Total production cost</td>
<td>Unknown in the beginning</td>
<td>Defined by construction contract</td>
</tr>
<tr>
<td>Success</td>
<td>Profitable business for a long time</td>
<td>Fulfil contract according to defined quality, within budget and time</td>
</tr>
<tr>
<td>Production site</td>
<td>Belongs to IJV</td>
<td>Belongs to project owner</td>
</tr>
<tr>
<td>Typical production</td>
<td>Autonomous</td>
<td>Integrative</td>
</tr>
<tr>
<td>Marketing</td>
<td>During production</td>
<td>Before production</td>
</tr>
</tbody>
</table>

Table 1: Characteristics of international equity and construction joint ventures
The production sites of equity joint ventures become construction sites with the difference that the construction site does not belong to the ICJV but to the project owner. As special purpose partnerships, ICJVs are more dependent on the mother companies. Equity joint ventures often have the legal status of a private limited company (Stephan 1999). A successful construction project completes the project on time, within budget and at the quality specified in the construction contract (Ritz 1994). Equity joint ventures exist as long as they produce an acceptable profit. An equity joint venture will start its business model with the consumer in mind. An ICJV will sign a contract before starting construction and will then work together with the owner; representatives of the owner will be present at every step of construction. Finally, in equity joint ventures concrete marketing activities take place once production has started. In ICJVs, signing the contract is the end of the core marketing activities. Table 1 summarizes the characteristics of international equity joint ventures and of international construction joint ventures.

The internal joint venture contract defines the rights and obligations between the partners and the ICJV. The construction contract does the same for the relationship between the ICJV and the project owner. The partners join their efforts for the first time for prequalification. After being qualified, they will jointly prepare the tender documents. These documents are submitted to the owner and if the owner decides to contract a specific bidding group and then the ICJV is formed. The ICJV partners are most often severally and jointly liable with regard to the owner for the performance of the tender.

Upon formation, two institutional entities are created: the ICJV board and the ICJV itself. In the ICJV board are representatives from the partners and the ICJV. It is an intermediate organisation linking the partners to the ICJV. Fig. 1 shows an ICJV system for the case of three international partners from two countries and one local partner.
Reasons and their importance given for joint venture formation in construction are technology transfer (20%), market access (15%), enlargement of financial resources (15%), risk distribution (15%), reduction of competition (10%), key account management (10%), local content clauses (8%) and access to local resources (7%) (Badger / Mulligan, 1995). Important factors for ICJV formation for megaprojects are the bid and the performance bond that the owner requests. Their amount can be 10% of the contract sum each and this weighs on credit limits. For a two billion US dollar project, we are looking at a credit of 400 million. Some construction contracts provide payment in Dollars, Euros or Yen to minimize money exchange risks. When we consider that local and foreign partners have at times differing interests than we can summarize the goals for ICJV formation as given in table 2.

<table>
<thead>
<tr>
<th>Goal</th>
<th>Advantage for</th>
<th>Disadvantage for</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk distribution</td>
<td>Both</td>
<td>Neither</td>
</tr>
<tr>
<td>Reduction of competition</td>
<td>Both</td>
<td>Neither</td>
</tr>
<tr>
<td>Enlarging financial resources</td>
<td>Both</td>
<td>Neither</td>
</tr>
<tr>
<td>Local content clauses</td>
<td>Both</td>
<td>Neither</td>
</tr>
<tr>
<td>Profits in hard currency</td>
<td>Both</td>
<td>Neither</td>
</tr>
<tr>
<td>Market access</td>
<td>Foreign partner</td>
<td>Local partner</td>
</tr>
<tr>
<td>Access to local resources</td>
<td>Foreign partner</td>
<td>Local partner</td>
</tr>
<tr>
<td>Key account management</td>
<td>Foreign partner</td>
<td>Local partner</td>
</tr>
<tr>
<td>Technology transfer</td>
<td>Local partner</td>
<td>Foreign partner</td>
</tr>
<tr>
<td>Know-how transfer</td>
<td>Local partner</td>
<td>Foreign partner</td>
</tr>
<tr>
<td>HR training</td>
<td>Local partner</td>
<td>Foreign partner</td>
</tr>
</tbody>
</table>

Table 2: Advantages and disadvantages through ICJV formation

Typically it is a disadvantage for the local contractors to share the market with foreign companies and it is a disadvantage for foreign companies to share their technology and know-how.

Managing international Construction Joint Ventures

One of the interviewed project managers formulated the start of an ICJV in the following terms: “But what happens in the start of these projects is that you suddenly have to throw a medium to large company together with no procedures, no processes, no understanding, no trust and you have to throw it into being as an operational organization at day one. And so you have a situation where nobody really knows what the other person is doing, why they are doing it, how they are doing it and even if they should be doing it.”
Given that similar ideas were expressed by several managers, it becomes possible to draw several main conclusions from the quote:

1. Complexity: At the start of an ICJV, the managers are faced with an overwhelming complexity. Managers do not use this term, they speak about chaos, many problems or big headaches. The complexity consists of a large number of possible pieces that are to be put together for the megaproject, many possible interrelations between these pieces and high impacts for a large number of the interrelation between pieces. In this complex system the manager needs to make decisions.

2. Decentralization: When a number of people work on different aspects of the project and nobody knows in detail what they are doing, then this describes a decentralized organization (or a lousy one). Decentralization becomes necessary when the density of work to be done in a given time period is too overwhelming for one person to control and direct. It is not a cultural phenomenon. Mintzberg (1992) advocates five different organizational forms. If these are arranged according to two dimensions from Hofstede – power distance and uncertainty avoidance, it can be shown that Asian countries prefer a simple structure with an apex: the project manager as mandarin (Hofstede / Hofstede, 2005). Data from the interviews show that this preferred structure was only implemented in one out of seven ICJVS with contracts to build the Taiwan High Speed Railway (ceteris-paribus clause applies). This ICJV was responsible for the smallest contract amount and was the least successful. All other ICJVs implemented a decentralized structure, although Asian companies from Taiwan, Japan and Korea were involved in all of them. Project complexity and the ensuing work density make decentralization a conditio sine qua non.

3. Learning: Although the quoted manager has an impressive amount of megaproject experience, he confesses that he does not know what needs to be done in detail. Every megaproject is a new learning experience for those involved and those who do not understand this point will fail. A relevant case study for this assertion is the Qatar Integrated Railway Project, where eight project managers were fired within four years. Each one came with the statement that he will provide the successful direction because he knows what to do. Typically companies prefer as a manager someone who professes that he knows what needs to be done and not one who is in search of a way. If the quoted project manager would have talked to his boss, the statement would have sounded most likely very different. Project managers for megaprojects need to be humble and willing to learn.

The management model as a result of the presented research is shown in fig. 2. It comprises five different levels. The first one includes tasks that are discussed in civil engineering. The second one contains five typical management tasks that are worked on at discreet intervals. The third level is set up by management tasks that are continuously going on, such as communication (Watzlawick et al. “you cannot not communicate”, 2011). The fourth level consists of basic
task that have the function of a lubricant such as sensemaking or trust. The fifth level is provided for by Hofstede’s five cultural dimensions (Hofstede / Hofstede, 2005) that were developed in sociology. Thus, the model is interdisciplinary. It is a depiction of what we call a cognitive map.

![Management model for ICJVs implementing megaprojects](image)

**Figure 2: Management model for ICJVs implementing megaprojects**

- **Complex engineering tasks**

As well as architects, civil engineers first of all learn how to design a product. While architects are specialized in the aesthetical and functional aspects of the design, civil engineers are concerned about the structural integrity (stability and usability). In order to create a design, processes are required and this is the task of design management.

Project management is what engineers do since five thousand years. There are professional organizations that codify such knowledge (Project Management Institute, 2013). However, for megaprojects, additional tools and techniques are required that exceed normal project management practice.
Construction management is the management of the production process and construction the process itself. The site installation is what in other industries the factories are; all the plant and equipment required to implement the design.

- **Management functions**

A good approach is to think about five management functions, i.e. planning, organizing, staffing, directing and controlling. This is a canon often discussed in the literature. Also common knowledge by now is that these functions are not linear (plan-determined). Managers in ICJVs start working without procedures. Typically they are pressed by each partner to implement this company’s procedures. The project manager has to satisfy the partners and create a coherent organization. As he and the other managers are trying to do it, they must resort to directing. Site installation begins, when there are no plans, no procedures and no organization. Several hundred employees from many countries and several thousand – often unskilled – workers need to be contracted, trained and put to work. It is not unusual to reach a production value (performance it is called in construction) of one billion US$ within a year. It follows that planning is iterative and follows production. A complete project management manual is quite often only available once the first billion US$ is spent.

- **Meta-functions**

Decision making, communication, coordination and learning are continuously ongoing. Communication takes a central role to prepare decision making, to support coordination and to facilitate learning. It is of prime importance and takes up the largest amount of time. Coordination is the central problem as there are so many people working (and being paid) on megaprojects. Decisions need to be made early and without much information. Learning accompanies and informs decision making. Of course, it is of paramount significance to have megaproject experience for the project managers (Brockmann, 2013). However, this should never obscure the need to learn, to develop and to adapt to the requirements of the project at hand.

- **Basic functions**

The basic functions have the task to facilitate all other tasks; they do what a lubricant does for a machine. Project knowledge exists from the bidding period, but often the project team is different from the bidding team. There is need for a knowledge transfer, more important is the elaboration and enlargement of this knowledge. For a decentralized ad-hoc organization, trust is not a choice or a social concept that is based on knowing each other; it is a task. If the project manager cannot trust other people without knowing them, he will fail because of the high work density. If team members exploit trust, consequences must be immediate and harsh (they are sent home). There is no other way to get a megaproject started (Brockmann / Girmscheid, 2010). Socially developed trust serves well in later stages. Sense making is a very interesting
problem and it can become highly disruptive when not properly managed. Typical signs of a sensemaking process are the rumors that float around the project. If not seen as malice, they are hypotheses proposed by an anonymous for understanding a specific part of the project (Brockmann, 2011). In fig. 3 a cognitive map for the sensemaking process is shown. Managing sensemaking allows reducing complexity by the development of common goals, team building as well as identity building and therefore increasing effectiveness. Starting point are the project goals as defined in the construction contract. Management tools are all communication events and they should be used throughout the project. Similar cognitive maps can be developed for all aspects discussed until now.

![Figure 3: Cognitive map of the sensemaking process](image)

- Cultural dimensions
Culture in ICJVS is often seen as a problem by academics. Experienced practitioners take it more likely as an asset. It enlarges the behavioral options (it increases the internal cognitive and operative complexity) for the ICJV and it is used to assign specific tasks. The local partner will deal with the (local) client, the foreign partners with the rest of the world for technology, know-how and resources. Through the local partner, the foreign companies do not only gain access to the market and its resources, they also hold the cultural key for the people surrounding and working for the project. A specific problem is a cultural difference between employees or workers and superiors. Often this is solved by having a local superior as well as a foreign superior for an
organizational entity. If not so, employees and workers often communicate with someone from their own culture who is heading a different part of the organization. This shows that besides the formal and informal organization in an ICJV there exists also a cultural organization.

Conclusion

ICJVs have the form of contractual joint ventures and are often created to implement megaprojects in construction. The other way around we can make a statement with more certainty: There are very few megaprojects that are not built by ICJVS. Construction megaprojects and ICJVs are two closely coupled phenomena in this world.

Megaprojects are characterized by their complexity (task, social, cultural, cognitive and operative complexity). Breaking down the task complexity from high to zero (completed project) while managing social and cultural complexity and by enlarging and adapting the cognitive and operative internal complexity of the ICJV are the tasks in abstract terms. Luhmannian system theory helps in this analysis (Luhmann, 1995).

In more concrete terms, it is necessary to pay attention to all facets of the management model. Failing in one area badly might compromise the project. What facets are most important, changes from project to project. How much attention to give to anyone also depends on the specific circumstances. Neglecting one is always a bad idea.

The management model is build from the cognitive maps used by practitioners in successful projects. As any map, a cognitive map is a representation of the real world. Therefore, prudence is required to see where these maps need to be redrawn. Construction takes place in a highly dynamic environment and this needs to be reflected when using cognitive maps. They are success factors when appropriate and shared by top management. Keeping in mind the size of megaprojects, coordination is the biggest problem and shared cognitive maps are one way of minimizing this problem.

References:


Eurostat (2012) National accounts - main GDP aggregates and related indicators


Hauptverband der deutschen Bauindustrie (eds.) (2011) Bauwirtschaft im Zahlenbild, Ausgabe 2011


Spradley, J. (1979) The Ethnographic Interview, Wadsworth, Belmont


