

INTERNATIONAL BUILDING DESIGN MANAGEMENT: RESULTS FROM A CASE STUDY IN SÃO PAULO, BRAZIL

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Abstract

Economic, social and technological factors have encouraged the procurement of architecture, engineering and construction services on an international basis, and have lead to the establishment of remote design teams in recent years. The use of foreign consultants for complex building projects in developing countries can induce technology transfer and the adoption of innovative architectural and engineering design. However, in practice, it can also result in additional risks that, if not recognized and mitigated in the early stages of the project procurement process, can lead to difficulties during the design and construction stages. This paper explores the technological, managerial, organizational and cultural barriers that may arise from the assignment of international offices for the design of complex projects in developing countries. Analysis of a case study for a major project in Sao Paulo suggests that assigning foreign design offices for complex projects requires careful planning, innovative managerial approaches, appropriate communication and information technologies, attention to behavioural issues and mutual understanding of stakeholders' roles and responsibilities.

Keywords: Building design, construction, contracts, globalization, project management, quality.

OVERVIEW OF THE ECONOMIC AND POLITICAL SCENARIO IN BRAZIL

With a population close to 179 million people, a GDP around US\$ 500 billion and a GDP per capita of 2800 dollars, Brazil has the largest domestic market in Latin America. Located in the Brazilian southeast, São Paulo is the country's most important city with the 3rd biggest population in the world, behind Tokyo and Mexico City. In terms of the Brazilian construction industry, São Paulo is also the most important region for development, with about 5.7 million square meters of new buildings built annually. Despite its socio-economic importance, the construction industry has been traditionally considered as backward compared to other industries. Frequently, construction methods are poorly chosen, workers are not properly trained and on-site supervision and project management are lax. As a result, extensive waste, and project time and cost overruns are pretty well standard. The Brazilian construction industry also lacks consistent industrial policies, since its activity level is often erratic and driven by political motivations, such as absorbing non-skilled workers.

The Brazilian industry is dependent upon government programs such as low-income housing, infrastructure, and other civil works. High cost of capital, credit scarcity and public expenditure shortage have slowed down the construction economic activity in recent years, regardless of a housing shortfall in excess of 5 million units. The Brazilian construction industry experienced significant changes during the nineties. However, the

roughly inconsistent economic growth in the past years may arguably affect the industry initiatives towards the improvement of its performance.

POTENTIAL BARRIERS FOR BUILDING DESIGN MANAGEMENT

In no other important industry is the design responsibility so detached from the production responsibility (Banwell Report, 1964). Harvey (1971) criticized the separation between designers and contractors in England and Saxon (1998) questioned the contractor's exclusion from the design process, seeing that designers are frequently expected to respond for elements that they do not fully understand. The construction industry presents a complex responsibility chain and nobody seems prepared to satisfy the client (Egan Report, 1998). Some commentators argue that designers could benefit from an early involvement of contractors, who are not usually involved before the tender process (Pocock *et al.*, 1997) under traditional procurement systems.

Frequently, designers and contractors are working together for the first time on a project. Even if the companies collaborated in the past, the assigned team member will be probably unknown to each other (Groák, 1992). The fact that project team members do not know each other in personal and organizational terms is not irrelevant (Brown, 2001).

The stakeholders commonly approach the project with particular expectations. Although these expectations vary according to the project type, clients usually seek for time and cost certainty and quality. Designers focus on aesthetics, functionality and a minimal use of resources. Conversely, contractors expect feasible methods, viable schedules and a profit margin commensurate with the transferred risks. The divergence of objectives can hinder team cooperation and encourage an adversarial approach. Selected due to their reputation, designers will focus on quality, whereas contractors, hired by competitive tendering, tend to concentrate on efficiency and economy (Bobroff, 1991; Nam; Tatum, 1992; Barlow *et al.*, 1997).

Architects have been accused of abandoning their responsibilities within the project team (Weingardt, 1996) and studies point out that they have been increasingly replaced by contractors and project managers in the design management role (RIBA, 1993; Gray *et al.*, 1994), due to poor communication with clients and faulty cost and time management. The Tavistock Institute (1999) recommends the appointment of architects to integrate the design, and for other professionals to manage the project, since the latter involves unattractive duties to the architects that can be consequently neglected.

Clients' participation at an adequate level can demonstrably enhance their satisfaction with the investment and the likelihood of meeting their goals (Davenport; Smith, 1996). If clients adopt practices that promote a collaborative environment, the stakeholders will be encouraged to increase the quality and efficiency of their services in all stages of the process (Jawahar-Nessan; Price, 1997).

The procurement route can arguably influence the project performance and the integration between design and construction. The selection of procurement routes should consider aspects such as project type, building complexity, design and construction schedule and budget, and client organization and experience (Chan; Chan, 2000). Love *et al.* (1998)

suggested a range of criteria to establish the client requirements and inform the procurement choice: speed during design and construction, variability, flexibility to design changes, quality, protection against risks, complexity, responsibilities, total price and arbitration.

POTENTIAL DIFFICULTIES FOR INTERNATIONAL BUILDING DESIGN TEAMS

Despite recent developments in information and communication technologies, the communication between different organizations or even within a single organization has been pointed out as one of the main drivers of failures in construction projects (Franks, 1998). A study carried by British insurance companies pointed to poor communication and lack of coordination as primary drivers of client dissatisfaction, claims, frustration with unattended items, lack of positive relationships and incomplete information (Brown, 2001).

Communication and functional issues, which involve not only the organizations but also the individuals, cannot be ignored. Without an analysis of individual skills, cultures and interests, there will be little understanding of roles and respect for leadership structures, which can intensify the rivalry and reluctance to cooperate. Issues such as roles, cultures and communication must be addressed if personal skills are to be optimized on behalf of the team (Brown, 2001).

Information and communication technologies have rapidly evolved in recent years. Companies have developed collaborative systems and have started to offer services that enable project team members to cooperate in a virtual project environment. Potential benefits of the collaborative systems can include reduction of communication failures, savings with posting and photocopying, speed, safety, privacy in data transfer, automatic issue of reports and elimination of document control and distribution procedures (Chinowski; Rojas, 2003).

However, project members tend to operate in isolation within collaborative systems, which inhibits the establishment of trust and the awareness of individual roles. Therefore, project managers need to reinforce individual roles and conciliate team members' expectations throughout the project. They should also set parameters for information exchange to reduce the likelihood of exponential increases in data flow or an information overload. Consequently, remote project teams can benefit from leaders who are able to communicate and establish relationships (Chinowski; Rojas, 2003).

In this context, international design teams can theoretically aggravate the difficulties for communication and collaboration, due to factors such as remoteness, lack of personal relationships, preconceptions, lack of adequate technologies to support communication and data transfer, language differences and different individual and organizational cultures. Despite the advantages of hiring foreign offices, such as technological transfer, adoption of innovative design concepts and awareness of aesthetic issues, there are potential disadvantages that should be properly managed to reduce the likelihood and impact of their occurrence.

Wang (2000) lists some difficulties in the involvement of foreign designers in China: selection by *competition of ideas* did not consider the size, reputation and capacity of the design office; lack of compliance with local standards that induced design changes; difference in plans and specifications that required further detailing by local design institutes; the fact that foreign designers are not used to the local market and local clients are not used to the amount of imported components installed in the building; the insufficiency of communication techniques; the differences in the languages; the distance (for travel); and the need to hire local offices to redraw the plans and specifications. On the other hand Wang (2000) also highlights the relevance of the functional arrangement of foreign and local design teams for project performance. Appointing the foreign designers for the coordination can bring about advantages, such as fidelity to the original design intent, but contractors may find difficulties during the construction. Alternatively, the client can assign a local design institute to detail the plans and specifications so as to enhance the design understanding by local contractors. Wang suggested the involvement of foreign designers in the detail work, and the appointment of local design institutes from the project outset in order to adapt plans and specifications to local standards and enhance the understanding of the designs by the local contractors. It is assumed that this functional arrangement can prove equally beneficial in Brazilian projects that involve foreign design firms.

CASE STUDY RESEARCH METHODOLOGY

According to Yin (1994), the technical scope of the case study can be defined as “an empirical investigation that observes a contemporary phenomenon in a realistic context, especially when the boundaries between the phenomenon and the context are not clearly evident.” Investigations that focus on the linkages between organizations may require the use of multiple sources of evidence and the consultation of multiple units of analysis to produce more reliable outcomes. Therefore, semi-structured interviews were applied to seven professionals involved in a case study project: representatives of the construction firm, designers and project managers. Based on the reviewed literature, the interview questions comprised closed and open questions regarding the following variables:

- i) integration: quality of interaction between project team members;
- ii) project performance: time and cost certainty, compliance with client’s objectives, and absence of claims;
- iii) procurement: method for the selection and organization of the project teams for the obtainment of a building by a client. The selection criteria for the project considered the participation of Brazilian leading companies that have already implemented a quality management system.

COORDINATION PROBLEMS WITH FOREIGN DESIGN IN COMPLEX BUILDING

With a total floor area of 82,000 square metres and an estimated cost of R\$ 160 million, the case study project creates a distinctive reference in São Paulo’s landscape. A Guaranteed Maximum Price contract divided into four progressive stages was adopted. The contractor was selected through a closed bid followed by a negotiation stage. The selection criteria took into account technical, economical and financial criteria. The original design was developed by offices located in Chicago and New York, and then adapted by local architecture and engineering firms. A project management office from

Chicago settled a branch in São Paulo to support the owner in the project. An Argentine designer that worked for the client on another project in South America was responsible for the adaptation of the structural design, originally developed in the United States. The organisational structures for the project and the design team are shown in Fig. 1.

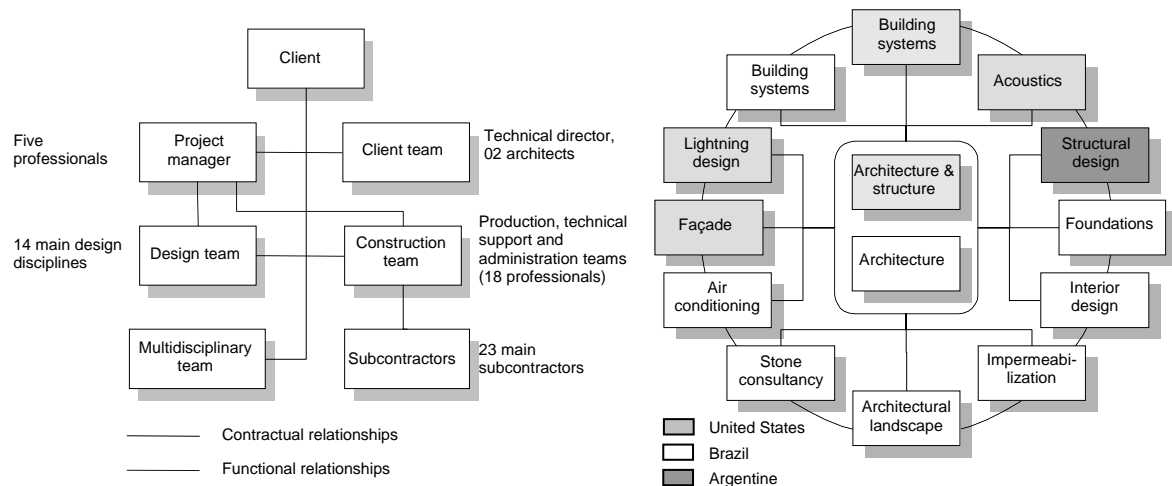


Figure 1 - Project and design team organizational chart

The case demonstrated that the appointment of foreign designers induces innovation and technological transfer, but can adversely impact the design management as a number of technical, managerial, cultural and economic factors, such as the development of the local supply chain, must be analyzed in advance. In this context, the design management demands a careful management of the work scope for each designer, an intensive configuration management, clear authority lines, mutual understanding of roles and responsibilities, interface management and an adequate selection of the local practices. The design management may be also influenced by the organization of the design team or the roles and responsibilities assigned to each designer. The following items discuss some of the difficulties faced by the project team due to deficiencies in the design management for the case study project.

Deficiencies in the selection of local and foreign design offices

The design concept was praised as outstanding and innovative by the project team. However, the team members admitted that the detailed design responsibility should have been assigned to local Brazilian offices from the outset of the project, due to their greater familiarity with construction methods and faster decision-making capacity. However, the local design offices were considered unsuitable as the project was complex. According to the contractor, “it’s inconceivable that one of the largest design offices in São Paulo doesn’t know dry wall. This reflects a wrong selection of partners” (contract manager). The design coordination was also criticized: “When you assemble designers, they don’t talk to each other. The coordination is not done or if it is done, it is not well done”. According to a project manager, “the architects are considered efficient when they’re able to make drawings compatible. But they’re not always suitable to coordinate”. The structural design was severely criticized by the Brazilian engineers: “A structural engineer could find examples of solutions adopted worldwide. There isn’t any standardization. They possibly used all the solutions available in the concrete books”. The

structural design was considered conservative not only due to the lack of specialization of North-American designers but also to their lack of trust regarding the quality of the Brazilian construction process. A consultant hired by the construction firm reviewed the structural design and found serious errors, such as beams with only 50% of the required reinforcement, which would endanger the building rigidity.

Difficulties in the use of the foreign designs

The team members criticized the assignment of foreign offices to detail the design. Despite the innovation assured by the incorporation of the original design intent, it raised further difficulties for the design management, since suppliers usually play an essential role in the design process in the United States. Despite international experience in more than 50 countries, the foreign design practice simply assumed that Brazilian suppliers would develop the shop drawings. As North-American offices delivered the construction documents, the Brazilian contractor noticed that plans and specifications were insufficient to inform local subcontractors and suppliers. This failure led to delays and hampered the mutual understanding of design team members' roles and responsibilities. Initially, a Brazilian architect, who worked for the foreign practice, was intended to coordinate the design. However, it was not feasible, seeing that foreign designers "never made decisions during meetings. They're technically defensive. As the project was delayed, it wasn't working. Foreign designers don't overcome contract terms and don't run unnecessary risks". The specification of imported components also raised difficulties for the construction firm, due to non-standard dimensions, connexions and executive methods. Moreover, the design team did not follow a precept of modular coordination in the project: "The modularisation of the concrete structure is different from the standards of Brazilian glass façade systems. There are different modularisations". The project also exposed weaknesses in the Brazilian supply chain: "It is unbelievable. A North-American plant delivered an innovative glass façade system faster than a local factory. It is unbelievable".

The poor quality of the briefing process

The architect stressed the importance of an intense involvement of the client's organization throughout the briefing process so as to mitigate the risk of late design changes: "If I had to start it all over again, I would start from the briefing. Closing a brief is one of the most important milestones of a project, but nobody seems to care about it. The client should have participated more actively. So, they came out later on with solutions used elsewhere, which could not be used in this building". The design management was largely affected by failures in the scope management and design change monitoring. The architect stressed the deficiencies in the briefing process: "The brief should be finished in a certain date. Then this date approached and there were a lot of changes. Nobody is to blame. We were not able to extract exactly what the client requested. This is a point that should be stressed".

Deficiencies in communication and information flows

The design management should define which information is relevant for each participant and establish communication structures, information flows, timetables and formats to transfer, record and distribute the information. The lack of communication procedures can lead to problems for the management, such as different levels of information between

project teams or even within a single team. According to an engineer: “I received information previously and then a drawing with different information. Then I found that the designer did not receive all the necessary information as well. Consequently, he issued drawings that differed from what was agreed on earlier. There are three or four client representatives directly involved in the process. So, different people deal with the information and sometimes it does not reach all the recipients. I received information from the project manager that differed from that sent by the client. There are too many people involved, but not in an organized way”. The complexity of the project and the unusual number of participants hindered the communication process, which could have been simplified by collaborative systems and agreed upon procedures.

Deficiencies in the control and issuance of design reviews

The ongoing design changes and lack of criteria for the issuance of design reviews postponed the definition of critical items. The contractor criticized the designer’s lack of commitment with the project milestones: “We halted the works in some floors as we didn’t know how to go on. The most important floors for the client are exactly those where the design is more delayed”. Frequently, reviews did not solve design errors and slowed down the procurement of subcontractors and the distribution of the drawings to the site: “It seems illogical for me, because issuing a review is time-consuming. In some cases we received out of date reviews. Whenever a review is issued, it has to contain up-to-date information”.

The contract manager criticised the planning of the reviews: “We have drawings with more than 20 reviews. Why? It is linked to the lack of planning”. The process also exposed the lack of quality control procedures: “In the rush, designers deliver anything. Nobody reviews or coordinates. These problems occurred due to the lack of coordination. The drawings are simply incompatible”. The successive issuance of design reviews also hindered the distribution of drawings to the site. The construction firm almost sent the 14th version of a drawing to the site instead of the 15th one as the drawings were sequentially issued by the design coordination. Because decision-making in design review meetings was pretty fast, drawings did not always incorporate up-to-date information timeously. As a result, the construction firm had to modify its quality control procedure as to enable the receipt of incomplete or under-approval drawings, which were given partial approval and distributed to the subcontractors through coordination meetings.

Lack of information and design incompatibilities

The lack of information also affected the contracts with the suppliers and obliged the appointment of additional professionals to the construction team. Initially, a small team was assigned to manage lump-sum contracts, which were replaced by unitary costs contracts due to the lack of information. According to the contract manager: “I shouldn’t care about it, but I spend 20 to 30% of my time trying to treat the consequences of a poor design. The design is calamitous in this project”. The construction team reported material errors and omissions and stressed the absence of quality control procedures. The design errors overburdened the construction team and affected the cost estimation. An engineer pointed out that “all the technical, procurement and construction problems in this project are related to the lack of information”. A delay in the choice of the stainless steel of the façade postponed the schedule by four months. The contract manager complained:

“We’re once more building without a design. The owner wants to launch the project, but had he decided to finish the design earlier, he could have saved time and money”.

Demand of mutual understanding of roles and responsibilities

The architect criticized the lack of authority lines in the design management, despite other team players’ argument that the coordination was clearly assigned to the architect.

However, typical roles of the design manager, such as the control, registration, distribution and issuance of documents, as well as quality control and change management were undertaken by the construction team, who prepared a spreadsheet to guide the architect. According to an engineer: “We require it to build. I take a look at the drawings to identify missing or conflicting data and inform them through meetings, e-mails or letters. I collate the data and require the inclusion in the design”.

These difficulties were partially caused by a poor understanding of the design team members’ roles and responsibilities and a lack of recognized leadership. The dissatisfaction seemed to emerge from unrealistic expectations, preconceptions and conflicting requirements. The team members clearly presented different understandings of their roles and responsibilities, as suggested by the architect interview: “Someone has already said that deadlines were not established to be met. I haven’t seen a single deadline met in this project. Now they set an unlikely schedule. They’re getting nuts to meet it. But we will succeed and it is going to end up with a big party”.

Divergent interests and expectations between project team members

Poor coordination procedures led to difficulties, such as different information levels between the project teams; “Three people from the client organisation worked directly in the process. So, I receive data from the project manager and from the client, what leaves room for doubts”. Coordination procedures, implemented and supervised by each team leader, should have minimized the emergence of different information levels between the project teams. The architect emphasized the conflicting interests between designers and contractors: “This is absolutely normal. We’re acting on the client’s behalf. We are protecting the client’s interest in this project; the contractor is protecting his interests”. He also criticized the architect’s detachment from the construction and complained about recent changes in the professional roles, which illustrate the rivalry between architects and engineers, and the reluctance to change: “Architects are unaware, what gives engineers the opportunity to enter the market. Engineers are not the same anymore. I used to learn with them. Now they become bureaucrats who manage the contract to meet the schedule, even if they have to destroy their partners. It is really a battle in this aspect”.

Designer’s detachment from time and cost management

The contract manager criticized the designer’s detachment from cost and time management: “It is clear to me. There is an ancient detachment of designers from cost management that leads to construction problems. There is a deadline and I don’t know what I am supposed to do for some floors. I am not inventing it”. Excessive design changes and late decision-making affected the progress of the project and the relationship between the team members: “Frequently, the work is already done when a design change appears. There is rework and a demand for new cost estimates. We try to identify the cost as the design is issued and negotiate it with the client. Then we have to procure it once again. This demands a close contract management”.

The contract could not be implemented as expected

The Maximum Guaranteed Price contract was praised by all parties as comprehensive and conducive to a high performance. According to the project manager: “It has a North-American structure. But it is organized and precise, and provides solutions for any contention”. Despite its strengths, the concept was not adopted, according to the contract manager, due to the lack of definitions in the design: “The cost should be reduced as the design was developed. However, we weren’t able to do it because we didn’t have complete design documents. We had to raise the price. So, we didn’t offer benefits to the owner”. According to the project manager, the inexperience affected the adoption of the contract: “This contract is clear for a North-American contractor. The second price is lower than the first. If the design hasn’t changed, the price is reduced. Differently, the contractor assumes a lot of things here based on assumptions”. The contractor disagreed: “The first cost estimate was R\$130 million, because there was only a schematic design. The first GMP was R\$128 million and the last R\$146 million. Something happened, right?” He also questioned the so-called “concurrent engineering”: “The engineering has been invented in Brazil. I’ve been working for 23 years. Today, it is much worse than in the past. It is not concurrent engineering if this concurrence occurs during the execution. I can’t procure a façade if I don’t know the type of glass or aluminium. This is not engineering to me, it is something else”.

CONCLUSIONS

The assignment of foreign offices for construction projects can bring benefits, such as technology transfer and innovative concepts for the design. On the other hand, it poses difficulties for the design management as it may aggravate coordination and communication problems, conflicting interests and lack of mutual understanding of roles and responsibilities among project team members. Therefore, it can raise risks to the project and induce delays, cost overruns, variations, claims and adverse impacts in the quality.

The assignment of foreign offices can affect communication and team building due to different languages, distance, impersonal relationships, lack of face-to-face contacts, use of inadequate communication technologies and cultural singularities. In the case studied, the foreign designers adopted a defensive technical attitude and delayed decisions in order to avoid liabilities, which slowed down the project in a critical stage.

Assigning foreign offices for the detail design work can assure fidelity to original concepts and compliance with specified solutions. However, differences in the content of construction documents, local contractors’ and subcontractors’ lack of familiarity with foreign plans and specifications, and complexity in estimating and procuring imported items can arguably affect the design and construction management. The North-American construction documents presented a lower level of information compared to the Brazilian ones, since North American subcontractors are usually expected to detail the design. Furthermore, communication problems emerged due to the assignment of foreign designers. The local design team had to learn English and the foreign team had to learn Portuguese. According to the contractor, nobody in the design team was fluent in English. Certainly, this aspect postponed the analysis of plans and specifications, affected the resolution of doubts, hindered the communication or induced failures in the interpretation

of the design documents. Teleconferences were utilized by design managers but without great success. Initially, plans and specifications were made available for downloading via the Internet. However, the system was abandoned as the majority of the subcontractors had never used it before. Additionally, the design documents distributed through the Internet bypassed the contractor's quality management system. Therefore, the availability of a technology does not guarantee its immediate success and acceptance by the project team as it commonly requires training and changes in the management.

The study also identified serious deficiencies in the design quality management, such as failures in the briefing and scope management, incompatibilities, interference, lack of criteria in the issuance of design reviews, excessive design reviews, lack of standardization and modularisation, and an excess number of late design changes. According to those involved in the project, these problems emerged due to three main reasons:

- i) the project's unusual complexity;
- ii) deficiencies in the selection of the local design offices; and
- iii) lack of precepts, tools and techniques for the design quality management.

Although the volume of information exceeded expectations, it is assumed that a careful design planning and the adoption of simple precepts, such as the single statement of the information, could have reduced the problems faced by the project team. The spreadsheet developed by the contractors denotes a proactive approach that should have been encouraged. The design managers could have agreed upon an information demand schedule with the client and construction teams. Presumably, this initiative was not taken due to the conflicting interests, lack of trust and absence of genuine leadership within the project team.

The case study has highlighted some potential impacts of the trend for globalization in the construction industry, such as the purchase of goods and services in international bids and the establishment of international design teams. Remote design teams promote innovative personal and professional relationships, but conversely may create technological, managerial and organizational barriers for the supply chain integration. Therefore, innovations in management, technology and human resources are required as to establish trust and strengthen the cooperation in international design teams.

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