

Analysis of the Delivery Methods for the 2014 World Cup Stadiums

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With a growth of 14%, the construction industry in Brazil has experienced a large growth in the last 10 years mainly due to the 2014 FIFA World cup and 2016 Rio Olympic Games. Large investments were made seeking high performance in delivering these projects; however, the country is still experiencing low performance the delivery of construction services. This research analyzes the construction of 12 stadiums built for the 2014 World Cup, one of the 2 major investments made in the last 10 years (the other being construction for the 2016 Rio Olympic Games). This paper identifies the method of procurement delivery, the project cost and time deviation and the source of problems. Brazilian clients are constantly managing, directing and controlling their clients. The Brazilian construction industry has all the characteristics of a price-based environment. A proposed solution for the poor performance is the Best Value Performance Information Procurement System (BV PIPS) which has been able to improve performance, quality, and minimize cost delivered in construction and non-construction services.

Key Words: Industry Structure, Best Value, Delivery systems, Construction, Brazil

Introduction

Developing countries, such as Brazil, depend heavily on construction initiatives to increase their Gross Domestic Product (GDP) and develop their infrastructure. In trying to overcome the loss of GDP over recent years, Brazil has sought to increase their investments in the construction industry. Brazil has invested approximately US \$879B in construction between 2007 and 2014. Moreover, the amount invested in construction represented more than 9% of Brazil's GDP in 2014. By comparison, this percentage represented only 7.7% in 2007. During this period, there was an overall GDP growth of 17% [high]. This is not uncommon, as there is a direct correlation between construction investments in developing countries and the GDP per capita (Borensztein, et. al., 1998). In addition to these investments, Brazil was also selected to host the 2014 FIFA World Cup as well as the 2016 Rio Olympics, which gave Brazil a great opportunity to help improve their economy and develop their country.

However, the main difficulty Brazil faces in trying to improve their economy and level of development is in being able to deliver high-performing construction services. This is an issue experienced by many developing nations. Due to the limited resources and the great need to improve their infrastructure, the inability for a developing country to deliver high-performing construction services poses a severe problem to their development.

Countries worldwide have been experiencing difficulty in delivering high performance construction services. Some of the most recent reports identifying that only 2.5% of all projects could be defined as "successful", when assessed through scope, cost, schedule, and business benefits (PricewaterhouseCoopers, 2009). Construction reports have identified that poor construction performance is not limited to countries with minimal construction education and development, but even developed countries, with extensive experience in construction delivery, have had difficulty in successfully completing projects, on-time, within budget, with high customer satisfaction.

However, like other developing countries, Brazil uses the traditional construction delivery methods, such as design-bid-build, developed by the more established and experienced nations, often times with a less experienced workforce (Herrán and Rodríguez, 2000). The use of these methods coupled with inexperienced workers results in the same low performance experience in the developed countries. Although Brazil has experienced low performance in delivering construction projects, prior to this research there has been minimal documentation on key performance metrics and causes of the low performance.

For Brazil to continue to develop and improve their GDP, it must identify solutions to resolve the performance issues it has been facing with construction projects. Having experienced large cost overruns and time delays on the 2014 FIFA World Cup stadiums and currently preparing for the 2016 Olympics in Rio, it is the right time to try and improve the delivery of construction services in Brazil.

Problem

Brazil has experienced issues in delivering construction using the traditional construction delivery methods that have been developed by more experienced countries. The large cost and time overruns experienced building the 2014 FIFA World Cup stadiums is the most recent example of the issues Brazil is facing with its construction services. The current construction process provides minimal documentation on the key causes of the issues being faced.

Objectives

Analyze the 2014 FIFA World Cup stadium construction projects. Use the stadium projects to verify if the construction industry in Brazil has the problem of poor performance like the rest of the world. If the previous claim is validated, identify the cause of the poor performance in construction. Identify a solution that could improve the performance of the delivery of construction in Brazil.

Methodology

In order to identify poor performance and its causes in Brazil, the following steps were taken:

1. Identify delivery methods, and performance information of the World Cup Stadium Projects (WCS).
2. Identify the expertise background of the contractors delivering the projects.
3. Analyze the information and identify major risks and causes of poor performance.
4. Perform a literature research to compare WCS issues with other documented projects.
5. Perform a literature research to identify a solution with proven documented performance that could overcome the issues and improve the performance of construction in Brazil.

Research

The 2014 FIFA World Cup Soccer tournament is considered to be the biggest event that has occurred in Brazil. To prepare for this event, Brazil performed multiple large infrastructure projects in 12 capital cities, including amplification of airports, urban mobility and of course, stadiums. 4 new stadiums were constructed, 4 were expanded or revitalized, and 4 were demolished and reconstructed. 12 companies were contracted in 2009 to work in conjunction with financing organizations and governmental agencies for the delivery of the projects. The two main construction delivery systems used by the companies managing the development were:

- Design Bid Build (DBB): Is the most traditional system (60% of whole market), where the owner normally contracts a design company. Then, the performing construction contractor is selected by the lowest bidder that covers the project specifications (Assaf and Al-Hejji, 2006).
- Integrated Project Delivery (IPD): Is a system that contractually requires collaboration among the primary parties: owner, designer, and builder. Therefore, the accountability for project delivery is collectively managed and seeks to appropriately share it among all parties (Ogunbiyi, et. al., 2013).

Table 1 shows a breakout of the major stadium projects, identifying the type of work performed, the company that was hired, and the type of delivery method used.

Table 1

Only one project was delivered using IPD. (Abati, 2014)

No	Stadium	Type of Work	Company	Type of Contract
1	Amazonia Arena	Reconstruction	AG	DBB
2	Baixada Arena	Expansion	CAP	IPD
3	Beira Rio Stadium	Expansion	AG	DBB
4	Castelao Stadium	Reconstruction	CG, AM and B	DBB
5	Corinthians Arena	Construction	OD	DBB
6	Dunas Arena	Construction	OA	DBB
7	Fonte Nova Arena	Reconstruction	OD and OA	DBB
8	Mane Garrincha Stadium	Reconstruction	AG and VA	DBB
9	Maracana Stadium	Renovation	AG and OD	DBB
10	Mineirao Stadium	Renovation	CO, EG and H	DBB
11	Pantanal Arena	Construction	MJ	DBB
12	Pernambuco Arena	Construction	OD	DBB

The selection for the work occurred in 2009. All the companies that were selected to perform the work were Brazilian companies. Figure 1 shows three companies being responsible for 67% of the entire project (8 stadiums). All three of the companies were in the top 5 of the biggest construction companies in Brazil; OAS (OA) being the 5th largest, Andrade Gutierrez (AG) being the 3rd largest, and Oderbrecht (OD) the largest construction company (Utsumi, 2014). Among them, the companies average 60 years of construction experience, average of 153,000 employees and \$18.05B in revenue (Utsumi, 2014). Furthermore, five of them have completed projects worldwide and have been recognized by their large projects outside of Brazilian territory.

Analysis

The following is an overview of the 12 stadium projects that have been researched (Downie, 2014; Costa, 2014)

- Total planned cost = R\$ 5.97 Billion (US\$ 1.84 Billion).
- Total final cost = R\$ 8.38 Billion (US\$ 2.59 Billion).
- Total % over budget = 40%.
- Average of planned time = 27 months.
- Average of final time = 35 months.
- Total % delayed = 29%.

The final performance metrics of the projects can be seen in Table 2, showing the amount over budget and over schedule for the projects.

Table 2 (Costa, 2014)

Performance Metrics

No	Stadium	Cost (Reais,* millions)			Time (months)		
		Planned	Final	Deviation	Planned	Final	Deviation
1	Amazonia Arena	515.00	669.50	30.0%	32	47.5	48.4%
2	Baixada Arena	184.50	326.70	77.1%	12	28	133.3%
3	Beira Rio Stadium	130.00	330.00	153.8%	20	40	100.0%
4	Castelao Stadium	623.00	518.60	-16.8%	20	20	0.0%
5	Corinthians Arena	820.00	1,200.00	46.3%	30	33.5	11.7%
6	Dunas Arena	350.00	400.00	14.3%	28	29	3.6%
7	Fonte Nova Arena	591.70	689.40	16.5%	27	31	14.8%
8	Mane Garrincha Stadium	745.30	1,400.00	87.8%	31	36	16.1%
9	Maracana Stadium	600.00	1,050.00	75.0%	28	34	21.4%
10	Mineirao Stadium	426.10	695.00	63.1%	35	37	5.7%
11	Pantanal Arena	454.20	570.00	25.5%	32	49	53.1%
12	Pernambuco Arena	529.50	532.60	0.6%	28	32	14.3%

*Cost left in Reais due to instability of conversion rates

Among the 12 projects, there was only one stadium, Castelao Stadium, delivered on or under budget and on schedule. However, it presented many infrastructural problems upon completion that caused high customer dissatisfaction. Baixada Arena was the only project that was delivered through IPD. The performance results identified it has the project with the most schedule delays and one of the highest cost increase.

The performance metrics of the stadiums confirm that Brazil has experienced the same issues of poor performance in construction similar to other places in the world and more developed countries.

This occurred despite the years of experience and all projects being unique. All companies faced similar issues when trying to deliver the projects (Mendonça, 2014):

- Financing.
- Contract changes.
- Unforeseen schedule delays.
- Inconstancy of work.
- Unsafe work conditions.

The major source of problems were due to disagreements between project stakeholders, such as government parties, financing companies and construction corporations. Through literature research, additional sources of issues were found (Mitra, 2014; Waldron, 2014; Martha & Voakes, 2013; Watts, 2013):

- Bureaucracy.
- Little-to-no planning.
- Lack of transparency.
- No risk management plans.
- Focus on technical details.
- No accountability.

Documentation shows that these issues/sources are not specific to the Brazilian stadium projects. A study by PricewaterhouseCoopers found that only 2.5% of 200 companies successfully completed all of their projects across various industries. The main causes identified by the Gallup group are (PricewaterhouseCoopers, 2009):

- Lack of leadership.

- High involvement by the wrong party.
- Scope management and communication.

Solutions

The issues that occurred on the FIFA World Cup stadium projects are representative of the majority of construction projects in Brazil. They are also not unique to Brazil.

A literature research was performed looking for potential solutions that have been developed to mitigate the issue experienced. The literature research consisted of 4 major academic databases and 780 number of articles. There were over 133 solutions found. Out of the multiple solutions that were identified, only the Best Value Performance Information Procurement System (PIPS) was found to have documented performance information supporting its ability to solve the issues experienced on projects (Rivera, 2014).

Another study performed in 2008 by a CIB Task Group (TG61) performed a worldwide study identifying innovative construction methods with documented high performance results. Best Value - PIPS was one of three construction methods found in the research. It was found that 75% of all papers that had documented performance of a system supporting the BV PIPS.

In looking at all the potential solutions, Best Value PIPS was the only construction method found to be able to solve issues. None of the other methods are an option since little-to-no documentation exists, and that which is documented shows poor performance. The only other construction delivery method with documented high performance was design-build; this was through a 1998 study (Konchar & Sanvido, 1998). The study's findings, however, were later overturned by a later study in 2015 led by the Construction Industry Institute (CII). The 2015 study sought to compare the findings of the 1998 study with more recent data and took into account more than just the delivery method. In summary, the study found that delivery methods alone do not predict success. (Pennsylvania State University & University of Colorado at Boulder, 2015; Leicht, Molenaar, Messner, Franz, and Esmaeili, 2015; 2015a; 2015b; Molenaar, Messner, Leicht, Franz & Esmaeili, 2015).

Therefore, Best Value PIPS is the best option to investigate in order to prevent issues such the ones experienced in the construction process of the World Cup stadiums.

Best Value Performance Information Procurement System

The BV PIPS was derived from the idea of the industry structure model (IS). The IS identifies that buyers desire to have high competition (right side of Figure 1). The IS then differentiates between high performing services and low performing services as the "Value Based" and "Price Based" quadrants. The major difference between buyers receiving high performance and low performance being due to owner management, direction, and control of the vendor.

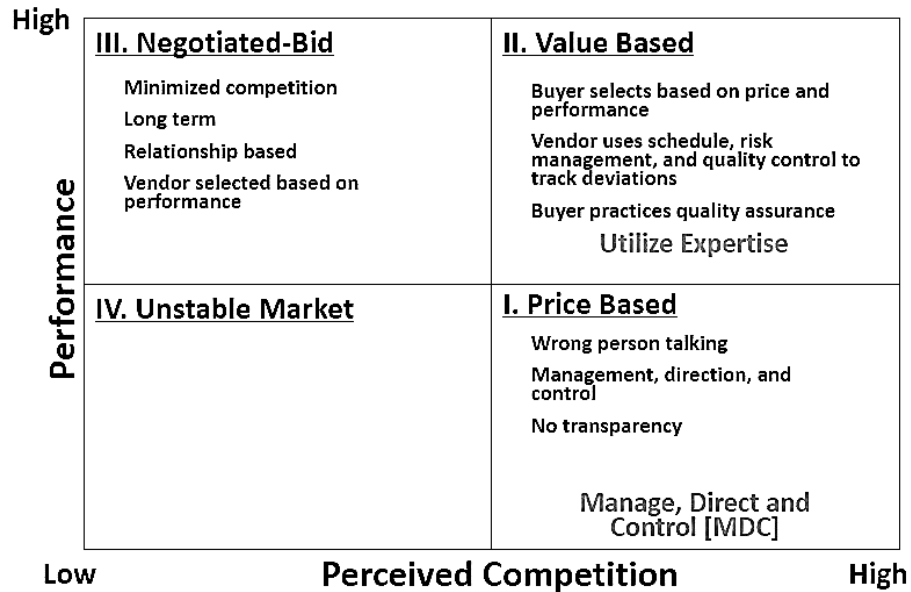


Figure 1 (Kashiwagi, 2015)

Characteristics of the “Price Based” and “Value Based” quadrants can be found in Table 3 Most delivery system are found to have “Price Based” characteristics. When comparing the “Price Based” characteristics with the characteristics found in the FIFA World Cup stadium projects, many of the characteristics were correlated.

Table 3

Observations of the Price Based and Value Based environments (Kashiwagi, 2015)

Price Based / Low Bid	Value Based / Best Value Approach
Decision Making	Minimized Decision Making
Management, Direction and Control	Utilization of Expertise
Focus on Technical Details	30K View
Increase Communication	Use of Simple Metrics
Relationships / Silos	30K View
Vendor does not create a plan for the project until after a contract is awarded	Vendor plans entire project before a contract is awarded
Non Transparent	Transparency

The performance documentation and the correlation between the “Price Based” quadrant and the FIFA World Cup Stadium projects identified the BV PIPS as a potential solution to resolving the low performance experienced on many construction projects.

The PIPS process has been tested in the construction and non-construction services for the last 20 years. It has delivered 1800 projects, with a 98% customer satisfaction rating and \$6.4B in construction and professional services procured, BV PIPS has been identified as solution to increase efficiency and performance in the delivery of professional services (Rivera, 2014).

Additionally, the BV approach has been successfully implemented in 7 countries around the world. Documentation has shown that it has been able to minimize many of the issues that were experienced in Brazil’s FIFA World Cup Stadium projects. The following are case studies of countries implementing the BV PIPS:

1. In the Netherlands, Best Value was introduced in 2006 and by 2012 it became the system of choice following the largest test ever ran of BV technology. This occurred through the procuring of a \$1B through Rijkswaterstaat. Upon completion, procurement time and costs were reduced by 50%, and projects were

completed 25% faster. These results gave Rijkswaterstaat the 2012 Dutch Sourcing Award and all governmental procurement firms licensed all of PBSRG's technologies.

2. In Canada, 8 of the top 25 universities procure services using the BV approach. At the University of Alberta, over 11 projects have been procured using Best Value, costing over \$200M. Service performance has increased 14% from the pre-BV environment, and the BV holds a 9.8/10 customer satisfaction.
3. Arizona State University [ASU] continues to be most reoccurring client with over 13 projects procured and ran using Best Value valued at over \$1.7B with 100% customer satisfaction. The 2 main projects have been on Dining Services, which had a 79% reduction in client management requirements and IT networking project, which saved ASU \$2.75M annually.

Conclusion

Brazil has had difficulty in delivering high performing construction which has hindered their economic growth. The performance of the stadium renovations for the 2014 FIFA World Cup has identified the magnitude of this issue, with projects being on average 40% over budget and 29% over schedule. The majority of the work was performed using the Design Bid Build delivery system and one project being done through IPD. Project metrics show that neither delivery process performed well.

A literature search on high performing delivery models identified the Best Value Performance Information Procurement System as one of the only systems that has had repeated tests showing improvement in project delivery. Further research on the system found that it has been tested in 6 countries and had a 98% success rate. The tests also shows it has been able to minimize the issues experienced in the Brazil stadium constructions.

The BV PIPS could be a solution to improve the performance of delivering construction services in Brazil. This could improve the economy and help in future initiatives like the 2016 Olympics projects that are currently being performed in Brazil.

References

- Abati, L. (2014, April 3). Veja a situação dos 12 estádios para a Copa do Mundo de 2014. *GrupoRBS*. Retrieved October 23, 2015.
- Assaf, S. A., & Al-Hejji, S. (2006). Causes of delay in large construction projects. *International journal of project management*, 24(4), 349-357.
- Borensztein, E., De Gregorio, J., & Lee, J. W. (1998). How does foreign direct investment affect economic growth?. *Journal of international Economics*, 45(1), 115-135.
- Costa, P. (2014, December 2). Custo das Arenas da Copa 2014 já chega a quase o triplo do orçamento inicial. *Abril Comunicações S.A.* Retrieved October 23, 2015.
- Downie, A. (2014, December 4). Brazil World Cup stadiums 50 percent over budget: Report. *Thomson Reuters*. Retrieved October 23, 2015.
- FIFA. (2007). Brazil Bid: Inspection Report for the 2014 FIFA World Cup™. *Fédération Internationale de Football Association*. FIFA-Strasse. Zurich, Switzerland.
- Herrán, C. A., & Rodríguez, A. (2000). *Secondary Education in Brazil: Time to move forward*. Inter-American Development Bank.
- <http://bim.psu.edu/delivery>
- Kashiwagi, D. (2015). *The Best Value Approach, Performance Based Studies Research Group*, Tempe, AZ. Publisher: KSM Inc., 2015.
- Konchar, M., & Sanvido, V. (1998). Comparison of U.S. Project Delivery System. *Journal of Construction Engineering and Management*, 124(6), November/December 1998, 435-444.
- Leicht, R. M., Molenaar, K. R., Messner, J. I., Franz, B. W., and Esmaeili, B. (2015a). *Maximizing Success in Integrated Projects: An Owner's Guide*. Version 0.9, May. Available at
- Leicht, R. M., Molenaar, K. R., Messner, J. I., Franz, B. W., and Esmaeili, B. (2015b). *Maximizing Success on Integrated Projects: An Owner's Guide - An Overview of the research and Owner's Guide*. 2015 Federal Project Delivery Symposium, Washington, D.C.

- Martha, M., & Voakes, K. (2013). Over budget and underprepared – Are Brazil’s stadiums ready to host the World Cup?. *Goal.com*. Retrieved October 13, 2015.
- Mendonça, R. (2014). Por que os estádios para a Copa atrasaram? BBC São Paulo, Brazil. Retrieved from: http://www.bbc.com/portuguese/noticias/2014/01/131230_estadios_copadomundorm
- Mitra, Arjyo. (2014). An Ethical Analysis of the 2014 FIFA World Cup in Brazil. *Sever Pillars Institute*, September 2014.
- Molenaar, K., Messner, J., Leicht, R., Franz, B., and Esmaili, B., (2014). Examining the Role of Integration in the Success of Building Construction Projects. *Construction Industry Institute & Charles Pankow Foundation*, January 2014.
- Ogunbiyi, O., Oladapo, A. A., & Goulding, J. S. (2013). THE APPLICATION AND IMPLEMENTATION OF LEAN DELIVERY METHODS IN PPP PROJECTS. *University of Central Lancashire (UCLAN) Preston, UK 18–20 March 2013*, 145.
- Pennsylvania State University, & University of Colorado at Boulder (Eds.). (2015). Maximizing Success in Integrated Projects - About the Study. Retrieved December 21, 2015, from <http://projectdelivery.weebly.com/about-the-study.html>
- PricewaterhouseCoopers (PwC). (2009). "Need to know: Delivering capital project value in the downturn." [http://www.pwc.com/es_CO/co/energia-mineria-y-servicios-publicos/assests/need-to-know-eum-capital-projects.pdf]. Accessed July 10, 2015.
- Rivera, A. (2014). Master’s Thesis, M.S. “Impact of a Non-Traditional Research Approach Case Study on the Performance Based Studies Research Group (PBSRG).” Arizona State University.
- Utsumi, I. (2014, May 26). 20 Largest Construction Companies in Brazil. *The Brazil Business*. Retrieved October 23, 2015.
- Waldron, T. (2014, July 14). The Four Biggest Stadium Boondoggles of Brazil’s World Cup. *Think Progress*. Retrieved October 20, 2015.
- Watts, J. (2014, July 21). Brazil’s protests raise fears for World Cup as a million take to the streets. *The Guardian*. Retrieved August 7, 2015.