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# Comparative Analysis of Alliancing and Public Private Partnership Cost Performance in Australasia Infrastructure Projects

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**Abstract.** Alternative project delivery methods such as Alliancing and Public-Private Partnership (PPP) are increasingly used to deliver complex infrastructure projects around the world and in Australasia in particular. Alliancing is expected to benefit owners with superior cost control, high levels of collaboration, and better risk management. Yet, PPP has remained the dominant provider for infrastructure projects. This paper empirically compares the cost growth performance of Alliancing and PPP in Australasia infrastructure projects under the lenses of Relational Contracting Theory and Transaction Cost Economics Theory (TCE). Data were collected from state records and previous studies on 48 completed projects. The analysis of the data using change order growth, bid growth, and project growth ratios shows that alliancing outperformed PPP in meeting cost expectations. These results challenge the traditional assumption of PPP superiority in delivering infrastructure projects.

## 1. Introduction

The construction industry, as an indicator of the country's wider economy, is a multi-million industry which underlies high-risk, high-cost transactions and long-term activities. However, the construction industry relies significantly on its governance structure which coerces the various construction players to interact in harmony to realize one big goal. Those governance structures are the construction contracts and law and what lay beneath it from procurement and project delivery methods.

Historically, governments have always tried to persuade the equilibrium between ratepayers' best interest and work providers financial interests and therefore the procedure of open bidding based on a competitive concept was first introduced. As a result, the bulk of infrastructure projects were procured using the traditional competitive bidding process [1-2]. Moreover, governments have always pursued the quest of achieving a vast range of economic, environmental, and social goals on behalf of their people [3-4]. This ultimately meant that huge capital is needed to be invested in infrastructure projects. Therefore, a diversity of mature and emerging project delivery methods that can cater those un diminishing needs was utilized. This project delivery diversity based on the 'fit-for-purpose' principle was being carefully selected based on the analysis of each project's characteristics and risks. Thereupon, governments are using alliance contracting to procure significant infrastructure [5-6].

However, with the world's accelerating wheel of economy, new approaches to deliver projects were in need. As a response to the increasing population as well as the common welfare the construction industry has evolved and matured in most countries and a diversity of new project delivery methods have appeared. In addition to the early 'traditional' methods such as 'design and



construct', and 'construct-only' contracts, projects are now being delivered using much more sophisticated methods such as public private partnerships and alliancing [7-8]. This layout sets the primary objective of this study which is to conduct a comparative assessment for cost expectation between PPP and alliancing for infrastructure projects in Australasia.

## **2. Alliancing project delivery method**

Alliancing delivery method is increasingly getting more and more attention in recent years as an alternative route to deliver complex projects to traditional methods and even some forms of relational contracting [9]. Alliance was considered as a new innovative procurement method that underpins the important pillars of relational contracting by emphasizing project management culture and relationships, Victoria [10] has a straightforward definition of alliance contracting as the following "The alliance structure capitalizes on the relationships between the Participants, removes organizational barriers and encourages effective integration with the Owner." That nictitates for project participants (owners and non-owners) to work together in good faith and collaboration to achieve an integrated working team that takes a decision based on the idea of "best-for-project" in a unanimous procedure.

Walker [11] identified Alliancing by pointing out the difference from partnering in that it is more "all-embracing" in its means of achieving unity of purpose and a high level of collaboration between project teams while having strong legal terms. Love [12] defined strategic alliance to be a form of alliancing which is adopted to establish the inter-organizational relations in order to achieve a specific purpose collaboratively and collectively. Victoria [10] emphasized the uniqueness of alliancing by combining both the owner and the traditional players in a collaborative relationship to provide a service, share the risk, and to collectively manage the responsibility in delivering the majority of the project stages, which was agreed on by Langfield-Smith [13]. Hence, the distinction between alliancing and traditional partnering lays in the fact that under partnering arrangement players still retain some independence and may win while other players lose.

Alliancing was the rational reaction from the urge to improve and to vanquish the litigious nature and adversarial unwanted impacts affiliated with traditional project delivery methods such as Design-Bid-Build (DBB) and Design and Construct (D&C) [14-15]. As an outcome to Relational Contracting stream, alliancing is seen as a binding form of collaboration between clients and service providers, where all expectations, commercial arrangements, financial planning, risks, and rewards are shared to incentivize project participants to give what is best-for-project to achieve a win-win or lose-lose situation. Without leaving possibilities for conflicts to materialize into a dispute by resolving unforeseen issues within the alliance and in an anonymous way [9,15].

## **3. Public-private partnership project delivery method**

Please Public Private Partnership (PPP) in general terms means a contract between the public and the private sectors. Under which key risks are transferred to the private sector by investing money, technology, or time, etc. through delivering tasks such as design, construction, maintenance [16]. In return, payments are made in exchange for the performance, that usually was delivered by the public sector. Though this broad definition covers a wide variety of contracts yet, researchers have reached no consensus regarding a firm definition of PPP [17]. Moreover, Hart [18] distinguishes PPP from other traditional contracts by noting that in PPP the building and operating stages are bundled which forms a strong incentive to expedite the process and to secure more funds for the operating stage. PPPs are appealing to governments since they enable the public sector to harness the inherited expertise and the high productivity of the private sector to deliver certain services that historically were conducted by governments [19].

Another reason why governments chose PPPs is that the finance structure does not require the governments to incur capital investments rather, the private sector is responsible for the cash flow of the SPV to implement the project [20]. Advantages of PPP in the construction industry are clearly visible in previous researchers works such as the enhanced relations between the public and the private sectors [21-22], better risk management [23], clearer government policies (19), revealed critical

success factors and appropriate financial analysis [24]. Which drove Shen [23], Edkins [25] and Ho [26] to advocate PPP as a prime tool for governments to better utilize their assets.

However, this glimmering upheaval did come along with its drawbacks. Since the presence of PPPs models might increase the competition and broaden the market, yet this comes with the syndrome of inflated contract prices that rots in the Transaction Cost Theory (TCE). Moreover, the collaboration which fosters the innovation and increases efficiencies might as well increase the asset specificity with forms the second pillar for TCE to take its downside [27].

#### **4. Alliancing and public private partnership departing points**

With a thin line constituting the difference between partnering and alliancing, Walker [11] articulated that while in partnering the partners retain independence, in alliancing, however, the parties form a cohesive entity and agree to abide an enforceable contract. However, Walker [11] pointed out that a “major difference between partnering and alliancing is that partnering runs alongside standard contracts and has no contractual force in itself (i.e., non-contractual partnering), whereas alliancing arrangements are expressed in contractual form (i.e., contractual partnering and collaborative working coupled with incentivization and risk-sharing schemes as in the New Engineering Contract)”. The review of Chen [28] identified some limitations of previous studies and knowledge gaps, namely the current studies on alliancing have seldom incorporated economics theories to examine and explain the application environment, benefits, and efficiency of alliancing.

Therefore, it was found that numerous researches have examined the Project Alliance (PA) delivery method to find that alliancing is plagued with two syndromes, each coming from a different philosophy. The first one being inherited from Relational Contracting Theory which is the soft approach in determining the Total Outturn Cost (TOC) of the project. While the second syndrome, which is intrinsically originated in Transaction Cost Economics Theory (TCE) is the opportunistic behavior in the mindset of non-owner participants (NOPs). However, when this perilous combination of factors coalesces and materialize in the process of estimating the original contract price, it only leaves the project owners with what is assumed to be an inflated contract price, while placing alliancing proponents with a consistent debate about the viability of choosing alliancing in order to meet owners' value for money [28-29].

On the other side of the construction industry in Australasia, there we have Public Private Partnership (PPP) which has been used in the Australian industry to deliver various types of projects such as roads, hospitals, prisons, schools, utilities and supporting facilities [30]. Yet, problems still arose for PPP projects such as: funding and operation drawbacks for toll roads [31], risk identification and assessment [32-34] and difficulties in achieving Win-Win situations with the lack of adequate legal, and economic models that are essential to PPP projects in order to work smoothly [22].

Nevertheless, despite our knowledge about alliancing innumerable advantages. Yet, from cost control perception, plentiful of researchers point out that there is much more that we do not know regarding whether the (TOC) incurs significant inflation during its process of determination? and whether project alliancing actually meets the cost expectation of owners' value of money when compared to its rivals? Therefore, this lack of adequate empirical studies that caught the attention of previous researchers formed a gap to build a new stream of empirical assessment for project deliveries in the Australian construction industry. Ergo, Project Alliance and Public Private Partnership require a holistic overview to examine them from an outside point of view. Thus, an empirical evaluation is needed.

#### **5. Methodology**

As the primary objective of this research is to examine the effectiveness of alliancing in meeting cost expectations. Therefore, it was only necessary to take a bird's eye point of view to contrast Alliancing with its other rivals, Public Private Partnership. Thus, a sample pool was decided to be Australasia construction industry which formed our first limitation. Secondly, in order to ascertain that this research takes no bias, this research was limited to infrastructure projects including (Transportation projects, Social facilities, Water treatment plants). Lastly, equations were adopted from Rojas [35]:

$$\text{Bid growth (\$)} = \text{original contract (\$)} - \text{pre-bid estimate (\$)} \quad (1)$$

$$\text{Change order growth (\$)} = \text{final contract (\$)} - \text{original contract (\$)} \quad (2)$$

$$\text{Project growth (\$)} = \text{final contract (\$)} - \text{pre-bid estimate (\$)} \quad (3)$$

$$\text{Bid growth ratio (\%)} = \text{bid growth (\$)} / \text{pre-bid estimate (\$)} \quad (4)$$

$$\text{Change order growth ratio (\%)} = \text{change order growth (\$)} / \text{original contract (\$)} \quad (5)$$

$$\text{Project growth ratio (\%)} = \text{project growth (\$)} / \text{pre-bid estimate (\$)} \quad (6)$$

### 5.1. Data discussion

Using Data Mining techniques, this research followed these steps: identifying the data; selecting the data; pre-processing the data; analyzing the data. Therefore, monetary data for completed construction projects included the Owner's pre-bid estimate, the agreed contract amount, and the final project cost upon completion was collected using two different measures. On the first hand, for alliancing data, a comprehensive and convenient data set for infrastructure projects in Australasia was found in a previous study [16]. On the other hand, Public Private Partnership data was collected from various studies. Yet, Allen Consulting Group report in 2008 constituted the bulk of it.

Further on, this study segregated the data to match the procurement methods PA and PPP by defining milestones to represent the lifecycle of the project. These milestones can be sequentially organized as the following: 1- Original Approval; 2- Budget Approval; 3- Contractual Commitment; 4- Actual Final Completion. With respect to different terminology between Alliancing and PPP, the definition of the milestones for PPP projects was comparable with the same milestones for Project Alliancing but with different terminology. This process was being carried out to validate that the various terminology will not be misinterpreted and so those values assigned for each milestone can be utilized for the numerical analysis appropriately.

Moreover, project selection criteria were set according to and cognizant of criticisms that have been leveled at previous studies. Therefore, this research took a neutral Bird's Eye on the current project deliveries. Hence, projects selected for further analysis were chosen carefully to represent the whole market by choosing completed PPP and alliancing projects and by including projects that were considered as ultimate case studies for both procurement methods. Consequently, two data sets were generated from the original obtained data including 27 Alliancing projects and 21 PPP projects (Table 1).

**Table 1.** Project alliancing and public private partnership sample size and value of projects in Australian Dollars \$

<i>Project Milestones</i>	<i>Initial Estimate (m\$)</i>	<i>Contractual Commitment (m\$)</i>	<i>Actual Final (m\$)</i>
Public Private Partnership (21 projects)	\$4,484.40	\$4,946.10	\$5,003.70
Project Alliancing (27 projects)	\$7,536	\$7,885	\$7,280

## 6. Results and discussion

Results for the three cost metrics can be summarized in Table 2:

**Table 2.** Means of cost metrics for alliancing and public private partnership

<i>Project method</i>	<i>Delivery Mean BGR (%)</i>	<i>Mean COR (%)</i>	<i>Mean PGR (%)</i>
PA	4.63	-7.67	-3.39
PPP	10.30	1.16	11.58

### 6.1. Bid growth ratio (BGR)

Bid growth ratio is an estimator that is used to describe the change from the pre-bid estimate to the agreed contract price. Table 2 illustrates that projects procured with Project Alliancing (PA) underwent a significant lower BGR with a percentage of 4.63%, less than half than the case of projects procured with (PPP) 10.3%. That can be a result of the high level of collaboration between the contracting parties in Project Alliancing, as in this method, the contracting parties set together workshops before they engage in a final binding contract and where the owner assesses the compatibility of tenderers not only based on tender price but also based on their experience and their collaborative mind-set of solving unforeseen problems. this finding falls in line with the assumption that alliancing has greater levels of collaboration [5].

Moreover, the owner takes advantage of having the Early Contractor Evolvement (ECI) which helps greatly in constructability reviews and in defining future work scope which was noted in [3]. Rather than the case in Public Private Partnership, where the bidder with the lowest price usually wins the contract based on the given work details from the owner then after the full appointment, the work details either get amended by variation orders or from the early beginning by advocating the owner about the design flaws, but in both cases the owner has to suffer any design increment alone and therefore, contractors see this as a possible window to add more income to the project which was noted by Rojas [35].

### 6.2. Change order growth ratio (COR)

The industry change order growth ratio (COR) refers to the changes in the scope of work agreed by the owner, contractor, and project engineers. Those changes can be added works or deleted ones from the original scope of work that was signed in the contract. However, depending on the magnitude of the change, it may or may not alter the original contract amount the completion date. As seen in Table 2, projects procured with PPP have suffered from a change order ratio of 1.16% which is statistically higher than the ratio for projects procured with Project Alliancing that showed a surprising negative ratio of -7.67%.

This negative COR ratio indicates that for Project Alliancing, the scope was altered to minimize the size of works. And based on the mechanism of the decision making with best-for-project approach as it was cited by Roehrich [16] savings were achieved through risk management, accelerated processes and innovative practices, methodology improvements that were developed and which subsequently improved action on repetitive processes, risks not being realized, improved quality assurance, and minimal business interruptions.

Knowing that in the embedded features of Alliancing, the anonymous decision making process with best for project approach provide a platform for scope changes and variations to take place without causing a significant delay nor the need for contractual negotiations as the case for traditional contracting methods where the contractor has to issue a request for variation followed by an extension of time till the point where the owner or the owner representative agree on such a request and issue a documented variation order in return. This could only highlight a substantial difference between Alliancing and other project delivery forms where goals are not aligned to match the contractors' commercial benefits only.

### 6.3. Project growth ratio (PGR)

Project Cost Growth represents the whole life cycle of the project from the owners' point of view. Such a ratio relies greatly on the owner from the perspective of an experienced owner to an inexperienced one, since experienced owners will have a better, more accurate estimate than those who indulge in the construction industry for the first time.

Project cost growth is defined as the difference between the final construction contract cost and the Pre-bid owner's estimate. The observable results in Table 2 indicated that Project Alliancing projects averaged a total of -3.39% cost growth from the owner's Pre-bid estimate to the final construction cost while PPP projects averaged 11.58%. The first interpretation of this significant difference is that PPP is not as effective at containing costs from the estimate to construction completion as Project Alliancing is. The segregated interpretation of how cost growth ratios change over the life of the project revealed a hidden difference as PPP projects averaged a 10.3% cost growth from the Pre-bid estimate to the contract award (BGR) and 11.58% cost growth from the Pre-bid estimate to construction completion (PGR).

While projects procured with Project Alliancing showed a non-significant difference from Pre-bid estimate to the contract award (BGR) with a 4.63% ratio but the whole project cost growth dropped notably to -3.39%. This difference in the whole project cost life firstly contradicts the common practice in the field which is found in traditional contracting methods such as D&B or DBB where owners experience cost savings from low bid results but pay more in change orders during construction. This is an expected result for alliancing that all the project players will firstly work on decreasing the final project cost as any increment will be incurred on both contractors and owners. Moreover, with the reward scheme in alliancing procurement method that works on rewarding most efficient contractors by providing them with more work packages being as a second motive for all the parties to reduce the final cost. That in return would most likely drive projects towards cost-saving while maintaining value for money which was clearly stated in collaborative approach praise found in Grasberg [5], Pinto Nunez [6] and Jacobsson [36].

## 7. Conclusion

Governments around the world are adjuring the liberal-economic-state which in its essence calls for equal sharing of opportunity in order to prosper. This research, on the first hand, is a tool to provide the academic knowledge base with empirical shreds of evidence of two of the most dominant project delivery methods. This research aimed to crystallize the differences between alliancing and Public Private Partnership from an economics point of view by drawing upon Transaction Cost Economics Theory and Relational Contracting notion.

The findings of this research challenge the assumption that PPP is a superior project delivery method that controls construction cost growth. Furthermore, when examining these findings from the Transaction Cost Economic Theory (TCE) perspective, the results provide crystal evidence that even with the existence of the opportunistic behaviour in construction transactions, yet alliancing countermeasures this behaviour and minimizes its impact to the minimum compared to other procurement methods.

Like any empirical research, this study is confined by several limitations. Firstly, the study scope was limited to infrastructure projects in Australasia from 2000 to 2012. Secondly, the data are obtained from previous researches and reports. Therefore, data might be subjected to various issues including bias and errors. Thirdly, sample sizes vary depending on the data source which was the case for PPP data that was limited to 21 projects. Finally, the data did not match the ordinal random sampling measures, since the data were essentially a sample of convenience.

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