Alliancing in Complex Infrastructure Projects

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ABSTRACT

The demands of complex infrastructure project management have shown substantial changes in the transition from the 20th to the 21st century. It is characterized as having many social and technical elements on different levels that are interconnected and independent serving the economy of an area. As projects get more complex and with higher risks, the need for a relational model is required to optimize and manage the risk. The alliance contracting model is a new project delivery method specially for delivering complex infrastructure project. It is the most complete form of relational contracting and has been developed to solve the challenges that complex infrastructure project faces.

This thesis explores the concept of alliancing in complex infrastructure project by comparing the results from the literature study with the ones obtained from the real-life case alliance projects. Quantitative analysis method was used for the study. Questionnaires, which were prepared based on the findings from literature, was analyzed using the Microsoft Excel.

This research point outs 14 complexities factors in infrastructure projects. Also, the study identifies 14 project qualities that makes a project suitable for alliancing along with 14 hard elements of alliancing.

Existing success factors and barriers to alliancing were studied, their relevance was cross-checked with the practical context there by generating new success factors and barriers.

The findings obtained will help new practitioners and academics to fully understand what alliancing is, when and how to use alliancing, what to consider and how to make it effective and successful.

Keywords: Alliancing, Complexities, Infrastructure, Alliance Element, Success Factors, Barriers, Project Delivery Method.

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ÖZ

Karmaşık altyapı projesi yönetimi talepleri 20. yüzyıldan 21. yüzyıla geçişte önemli değişiklikler göstermiştir. Farklı alanlarda birbirine bağlı ve bağımsız bir ekonominin sektör yapısına hizmet eden birçok sosyal ve teknik öğeye sahip olma özelliği taşımaktadır. Projeler daha karmaşık ve daha yüksek risklerle karşı karşıya kaldıkça, riski optimize etmek ve yönetmek için bir ilişkisel model gereklidir. Ortaklık sözleşme modeli, özellikle karmaşık altyapı projeleri temininde yeni bir proje teslim yöntemidir. İlişkisel sözleşmenin en eksiksiz şeklidir ve karmaşık altyapı projelerinin karşılaştığı zorlukların çözümü için geliştirilmiştir.

Bu tez, karmaşık altyapı projesinde literatür araştırması bulgularını gerçek hayatta gerçekleştirilen projelerden elde edilen sonuçlarla karşılaştırarak ortaklık kavramını araştırmaktadır. Bu çalışmada nicel analiz yöntemi kullanılmıştır. Literatürdeki bulgulara dayanarak hazırlanan anketler Microsoft Excel kullanılarak analiz edilmiştir.

Bu araştırma, altyapı projelerinde 14 karmaşıklık faktörünü ortaya koymaktadır. Ayrıca, çalışma, bir projeyi ortaklık için uygun hale getiren 14 proje niteliğini ve 14 zor ortaklık unsurunu tanımlamaktadır.

Mevcut başarı faktörleri ve ortaklık engelleri incelenmiş, yeni başarı faktörleri ve engelleri yaratılarak pratik bağlamda uygunlukları karşılaştırılmıştır.

Elde edilen bulgular, yeni uygulayıcıların ve akademisyenlerin ortaklığın tamam olarak ne olduğunu, ortaklığı ne zaman ve nasıl kullanacaklarını, neleri göz önünde

bulunduracaklarını ve bunu nasıl etkili ve başarılı kılabileceklerini anlamaya yardımcı olacaktır.

Anahtar kelimeler: Ortaklık, Karmaşıklıklar, Altyapı, Ortaklık Unsuru, Başarı Faktörleri, Engeller, Proje Teslim Yöntemi.

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ADIT	Australian Department of Infrastructure and Transport
ALT	Alliance Leadership Team
AM	Alliance Manager
AMT	Alliance Management Team
AOC	Actual Outturn Cost
DBB	Design Bid Build
D&C	Design and Construct
DTF	Department of Treasury and Finance
IPAA	Interim Project Alliance Agreement
KPI	Key Performance Indicator
KRA	Key Result Area
NOP	Non-Owner Participants
PA	Project Alliancing
PAA	Project Alliance Agreement
PAB	Project Alliance Board
PDM	Project Delivery Method
PDS	Project Delivery System
PM	Project Manager
PO	Project Owner
PP	Project Partnering
TOC	Target Outturn Cost
UK	United Kingdom
USA	United States of America

Chapter 1

INTRODUCTION

1.1 Background

With the continuous growth in population and economy in countries, the need for more infrastructures continues increase in other to satisfy the people's needs. The inadequacy of the present-day approach towards the delivery of the complex infrastructure projects has been broadly documented in international literature (for example, Priemus, 2007; Priemus et al., 2008). The search for a new way to promote and finance these complex infrastructure project in both the developed and developing countries has turned to method that are not all that new (Salet, Bertolini, & Giezen, 2013)

What are complex infrastructure projects? Complex infrastructure projects refer to structural system and facilities that are characterized as having many different social and technical elements on different levels that are interconnected and independent serving the economy of an area or country. The construction of infrastructure projects initiates the tension between the current traditional contracting and the other contracting approach, which are subjected to extreme complexity and uncertainty (Salet, Bertolini, & Giezen, 2013). In order for project owners to achieve optimal outcomes, they most select the most suitable procurement method to achieve their objectives.

With the different types of procurement delivery method (PDM) available today to deliver infrastructure projects, project owners expectation is still undermined i.e. completion with budget, time and right quality. Huge emphases are on PDM's that emphasizes on all parameters in project delivery, which are time, cost and quality (Babatunde, Opawole, & Ujaddughe, 2010). Also because of the fragmentation issues associated the most of the PDM's, practitioners have proposed to move towards a more collaborative and integrated approach (Egan, 2002).

According to Ashworth and Hogg (2007), the different types of procurement system or sometimes knows as delivery system are available to meet the project owners need and specifics. However, researchers often differ in the classification of these procurement methods. The reports from (Davis, Love, & Baccarini, 2008) in "Building Procurement Method" classified them as; Traditional (separated), Design and Construct (integrated), Management (package) and Collaborative (relational). However, collaborative form such as alliancing is typically used for high complex project.

The alliance contracting model is a new project delivery system (PDS) that is becoming popular and gaining recognition in recent decades. Originated from UK, where it was first used in the early 1990s to deliver complex offshore oil and gas projects. It has become a huge success in Australia. It is an appraisal to both the traditional contracting and other types of relational contracting. Recently, alliancing gained a global attention with many more countries adopting this method (Young, Hosseini, & Laedre, 2016).

Alliancing is a well acknowledges type of relationship-based procurement to be used for complex infrastructure engineering projects. Especially in Australia and New

Zealand due to its outstanding achievement (i.e. time/cost/quality) alongside other benefits (Walker et al., 2015; Walker et al., 2016).

According to National Alliance Contracting Guidelines (2015), Alliancing contracting is a method for infrastructure procurement in which the Government works collectively with a private sector body to procure major capital assets and agrees to share risk and opportunities together as the project progresses. It is also defined as a long-term business technique linking client, contractor, and supply chain together (Rowlinson & Cheung, 2004). All participants are required to work together, acting with integrity, in good faith and making best for project decision.

Scholars classified them into two main types namely; Strategic alliancing and Project Alliancing (Rowlinson et.al., 2016). Strategic alliancing deals with the establishment of inter-organization relation and collaborative behavior (Love et al, 2010), whereas project alliancing describes the project delivery system and the profits and risk sharing between the participants (Manivong & Chaaya 2000; Hutuchinson & Gallagher 2003).

This thesis will be focusing more on project alliance and will explore the complexities of infrastructure project. More specifically, this study will identify the qualities a project should have for it to be suitable for the alliance-contracting model. And also, issues associated with the identified project qualities will be addressed.

1.2 Problem Statement

Studies shows that all major infrastructure projects involve inherent risk such as political issues, economical change, technology, engineering uncertainties, ground conditions, land issues, environmental issues, climate, industrial dispute etc. thereby

causing project failure and other litigation problems (Salet, Bertolini, & Giezen, 2013).

The traditional risk transfer approach has been showing incompetent outcomes in dealing with these situations, even for the well-resourced construction firms when it comes to dealing with complex infrastructure projects (Mills et al., 2014). However, the alliancing model is a project delivery system for complex infrastructure projects. Its unique feature is resolving all conflicts between all parties including the owner without litigation (Young, 2016).

Recently more and more project owners and practitioners have turned to "project alliancing" to deliver complex projects in the resources along with infrastructure projects and the results so far keeps to be very impressive. Successful alliance projects have resulted in the savings of actual project cost by 20% (Rooney, 2009). It is compatible with the 21st century projects which are characterized by commercial, political and social dynamic risks (Mill et al., 2014).

1.3 Research Scope and Objective

The scope of this research study will be on the project alliance delivery approach on complex infrastructure projects.

Therefore, the major objectives of this study are;

- Firstly, to predetermine the factors that contributes to infrastructure project complexity.
- Secondly, to verify what makes and alliance an alliance by identifying a list of qualities an infrastructure project should have to make it suitable for alliancing.

- Finally, to indicate the key elements in alliance, success factors along with barriers that exist for the alliance contracting model.

1.4 Research Questions

To have a clear understanding and focus on this study, the following research question have been identified:

- What are the factors that determine a project complexity?
- What qualities make an infrastructure project suitable for alliancing?
- What are the key elements in alliancing?
- What are the key success factors when choosing alliancing in infrastructure projects?

1.5 Research Methodology

This study proposes a framework in which the research questions are going to be addressed by performing a literature and document study. A combination of both journal article and conference paper will be used. Data for this study will be collected with the aid of structured questionnaires survey and analyzed using Microsoft Excel, along with a conceptual framework for managing alliancing infrastructure projects with its managerial implications

1.6 Thesis Outline

This thesis comprises of five chapters. Chapter one, which covers is the introduction about the study. Chapter two present the literature review in order to provide a theoretical context about what is alliance, types of alliance, its risk sharing and risk transfers and other forms of procurement methods for complex infrastructure projects. Chapter three gives the theoretical framework of the alliancing model, qualities, elements, success factors and barriers to the alliance model.

Chapter four provides a description of the methodologies been used in this research. Whereas chapter five discusses the results from the analyzed structured questionnaires and compared to the theoretical framework alongside a model framework. Finally, chapter six, summaries the main findings and answers to the research questions along with recommendations to this study and for future study.

Chapter 2

LITERATURE REVIEW

This literature study is done to build up a theoretical background for alliancing. Both journal articles and conference paper in combination was used to gain a viewpoint of this topic. Industrial and Governmental publications on alliancing was also used as a document study, for instance Alliancing Best Practice in Infrastructure Delivery (IUK, 2014) and The National Alliancing contracting Guidelines (Department of Infrastructure and Transport, 2015). This was done to get the industry and government viewpoint on alliancing and to improve the academic perspective. Along the line, these two studies permit us to pick up knowledge into both the theoretical and practical aspects of alliancing. One quality of this literature study is that it is an approach to understand the present body knowledge of this chosen topic. Furthermore, because of the nature of the literature publication, they can be utilized as an approach to document the trends that have happened throughout the years.

2.1 What is Alliance?

The term alliance implores to different meaning depending on the framework used. Ordinarily the term alliance is defined to a formal agreement or treaty between two or more nation or organization to cooperate for a specific purpose. Also, it is defined as a relationship based on similarity of interest, nature or qualities. To the Australian public sector, the term alliance was defined as an “agreement between two or more bodies, in which they work cooperatively together to achieve the agreed outcome on

the basis of sharing project reward and risk based on the principle of trust, good faith and open book approach towards cost (Commonwealth of Australian, 2015).

However, the alliance-contracting model is characterized by risk sharing and a no blame/ no dispute framework. There are numerous and different definitions of the alliancing-contracting model and the degree and nature of the alliance that reflects the range of definitions that are in common interest (Yeung, John, Albert, Danial, 2007). These definitions are very wide for instance, “A relationship between two entities or bodies, large or small, local or foreign with shared objectives and monetary interests. Or organizations with the abilities and necessities meet up to work together and increase the value of the other partner, and at the same time produce a product which enhance the general public and competence of the ultimate client.”

For the alliance model, the Australian public sector defined it as “a public sector (the owner) works cooperatively with the private sectors (Non-Owner Participants, or NOPs) in delivering a major capital project”. The participants cooperate in accordance with good faith, acting with integrity to make best for project decisions (National Alliance Contracting guide, 2015). Also, as stated by the European Construction Institute (ECI), “Alliancing contracting model is a type long term partnering on a program of work or project in which commercial value schemes links with the overall outcomes and the rewards of each participant based on the arrangement in the legally binding contracts”. Also, according to Lloyd-walker et al., (2014), alliancing is the collaboration between client, contractors and service providers where they manage and share project risks together.

Alliance partners are chosen based on their expertise and capacity to achieve excellent performance criteria before cost is considered. In alliancing, competent, committed and trustworthy firms are welcome to join with the client establish the project. The alliance PDM can improve the value of money and project outcomes of a project due to high level of cooperation and integration between design teams, planners, operators and contractors (Walker and Lloyd-Walker, 2016).

2.2 Types of Alliance

Alliances are generally categorized by scholars into two types; Strategic alliancing and Project alliancing (Rowlinson, Chevy, Simes & Raferty, 2006)

2.2.1 Strategic Alliance

The strategic alliance is a long-term agreement used for outsourcing of services. Partners contribute resources such as project funding, products, distribution channels, knowledge towards their mutual goals. (Robertson & Robertson, 2015). Summary key words definitions includes; two organizations, increase revenue, value creating, long-term, success, formal agreement and trust. The strategic alliance formal agreement based on intensive cooperation and mutual trust in order to achieve goals that independent partners cannot achieve easily (Simoons, 2015). Firms enter alliances for reasons such as sharing risks, entering new market and building economies of scale. The strategic alliances can either be horizontal or vertical (Sarkissian, 2016)

The horizontal strategic alliances are formed between partners in the same business field. This type of alliance tends to be anti-competitive, therefore anti-trust law should be considered. The vertical strategic alliance is a partnership between a firm and its distributors or suppliers. Firms that produces their products and services

utilizes this method. It deepens the relationship between the firm and the suppliers or distributors through the exchange of commercial intelligence and know-how (Sarkissian, 2016)

2.2.2 Project Alliance

Project alliance is a well-known form of relationship based procurement delivery system for public infrastructure (Gransberg, Scheepbouwer, & Loulakis, 2015). As defined by the Department of Treasury and Finance, (2015), project alliance is a method of procuring and sometimes managing major capital assets, where state agency collaboratively works with private sector parties to deliver a project.

The project alliance is characterized by some number of key features, which requires all parties to work together in good faith, make best decision for projects and act with integrity. The participants work as a collaborative, integrated team to deal key project matters. It is mainly formed for an individual project afterwards all the parties are dissolved. (Commonwealth of Australian, 2015).

2.3 Phases of Project alliance

The project alliance model comprises of four (4) phases.

1. Establish alliance phase
2. Project Development phase
3. Implementation phase
4. Defect correction period

Figure 1 below provides an overview of typical phases in the project establishment and delivery process of a project using project alliancing.

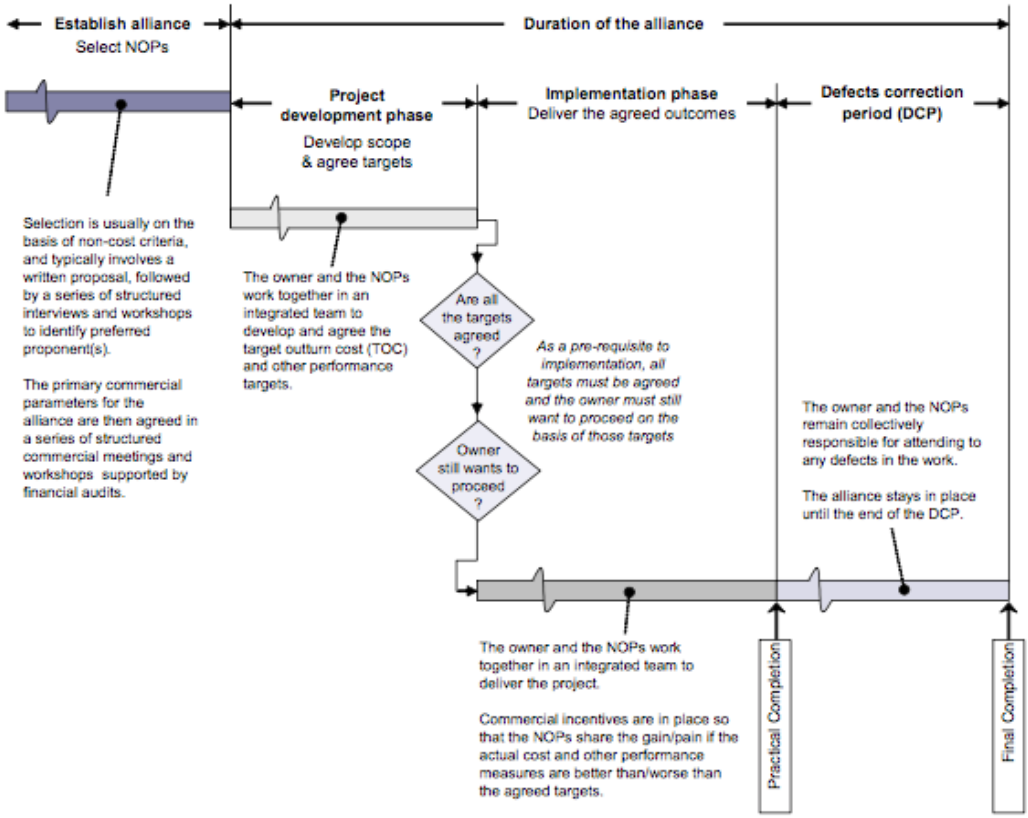

Figure 1. Typical Phases of Project Alliance (IUK, 2014)

2.4 History and Track Records of Project Alliance in Complex Infrastructure Projects

Project alliance first came into existence in the petroleum industry (Young et al., 2016). It originated in the 1980s and was used by the British Petroleum (BP) and others to deliver an offshore oil and gas project in the North Sea. The British Petroleum (BP) was the first company to use the alliance contracting on 'Andrews Oil Field', located in the North East of the United Kingdom. The project was characterized with large contractual risk and because of these high-risk ventures; the traditional risk transfer strategies would bring about exceptionally high contract contingency cost. This led to an alliance between the BP and seven other contractors. The alliance achieved a remarkable performance improvement in which the project estimate cost was reduced from £450 million to £373 million and the project was

then delivered six months ahead of schedule with the final target outturn cost of £290 million. An achievement previously was thought impossible (Young, 2016).

With the competitive nature of the traditional contracts and the success of the alliancing in the North Sea, the construction industry starting adopting the method. (Laan et al., 2011). Australia took the lead in the momentum builder and implantation of alliance contract at the early 1990s. The first alliance project was the Wendoo Alliance in 1994 for the construction of an oil platform in Western Australia West Shelf by Ampolex. Followed by the East Spar Alliance in 1996 and many others. With the continued success and magnificent achievement and performance, the Australian government is now the largest user of such contract in its infrastructure projects (DTF, 2010).

Alliancing is still gaining recognition as an alternative method for infrastructure in a global scale. According to Chen et al. (2012), most of the literatures and research on alliancing started in the from Australia and the UK with 39% and 23% respectively, Hong Kong 19%, 6% from both the USA and the Netherlands, Sweden 4% and only 1% each from China and Norway.

2.5 Overview of Procurement Method for Complex Infrastructure Project

The procurement is the process of purchasing goods or services. Building construction can be procured by many different routes. For infrastructure construction project the selected route should be a strategy which fits the long-term objectives. The procurement method is also as delivery system (Babatunde et al., 2010). As reported by (Davis, Love, & Baccarini, 2008), delivery system can be classified by as:

- Traditional (Separated)
- Design and Construct (Integrated)
- Management (Packaged); and
- Collaborative (Relational)

Nevertheless, an effective delivery system is fundamental to the success of infrastructure project process. Major infrastructure projects require huge value of money assessment of each available procurement option. The key objective is selecting the most suitable procurement delivery model that meets the owner/client objectives and provides the best value for money. (Sommerville et al., 2010).

2.5.1 Traditional Procurement

In the traditional procurement approach, there are three other contract types under this method. They are; (1) Lump Sum Contracts (2) Measurement Contracts (3) Cost Reimbursement. But the most common type of contract used for complex infrastructure projects is the lump sum contract also known as Fixed Price.

Lump Sum (Fixed Price): Commonly used form of contract by government to carry out infrastructure project. The government has full authority for the project design

and documentation but appoints a design team to develop plans and design (Davis, Love, & Baccarini, 2008).

2.5.2 Design and Construct Method

For the Design and Construct (D&C) contract, the contractor takes full responsibility of the design, whereby the design briefs the outline the key user requirement and functions for the works is detailed out. (Davis, Love, & Baccarini, 2008).

2.5.3 Management Procurement

In the management procurement, several forms of contracts exit which include Management Contracting, Construction Management and Design and Manage. Slight different differs from each contract type. Sommerville et al. (2010) recommends the CM for infrastructure projects.

Construction Management (CM): The contractor appoints a construction manager (contractor or consultant) to perform a managerial and coordinate the construction work on its behalf.

2.5.4 Collaborative Method

The collaborative procurement method is an effective way for one or more client, consultant, contractor or supplier to join together to procure services, works, good or materials, promotes efficiency, share expertise and deliver assets to save money in delivery of a project (Construction Execelence, 2015). Forms of collaborative approach such as alliancing and partnering are typically used for high complex project (Davis, Love, & Baccarini, 2008).

2.5.5 Public Private Partnership Model

The Public Private Partnership Model or PPP model is mostly a service between the private sector and the public, where the private sector gets paid by the government to deliver an infrastructure project or related service over a long term (Babatunde,

Opawole & Ujaddughe, 2010). The PPP can be delivered through various approaches such as

- Design Build Operate (DBO)
- Design Build Finance Operate (DBFO)
- Design Build Finance and Maintain (DBFM)
- Design Build Operate Maintain (DBOM)

2.6 Project Alliance (PA) and Project Partnering (PP)

In the beginning of alliance, project alliances (PA) and project partnering (PP) shared many similarities than the situation today. Project alliance and project partnering were interchangeable before PA advanced over time away from PP (Spang & Riemann, 2014). PA is a step further from PP because it does not inherit the PP misalignment between the collaborative relationship system and legal contract. The PP is built on the fundamental of standard win/lose philosophy (AS2124 Australian Standard Contract) while PA crate a direct alignment with its collaborative system by eliminating the option of win/lose philosophy from its legal contract (Rooney, 2009, Chen et al., 2012, Lloyd-walker et al., 2014).

The greatest distinction today, is that the PP is not an independent contract strategy and use over the conventional contracts, for example D&C (Yeung et al., 2016, Lahdenperä, 2012). Meanwhile the PA is a built-for-purpose, an independent contract strategy and it employs an open-book approach (Haugseth, 2014).

Furthermore, the preferred way to understand and learn the PA approach is to experience it firsthand. Freud made a point that you truly only understand and know

what has occurred in an event after you experience it. Evolving and learning emerges out of that experience (Young et al., 2016)

2.7 Establishment of Alliance

2.7.1 Establishing of Project Alliance

2.7.2 Overview of Process

On selecting to use project alliance, the next crucial step is for the government to setup the alliance framework and choose the right participants to join the alliance and deliver the project (Commonwealth of Australian, 2015). Figure 2 below shows the establishment framework.

The overall process is divided into two stages

1. Request for Proposal (RFP) development: Establish the alliance model and invite submissions from the advocate people; and
2. Evaluate and Selection: Selection of the service provides (NOPs).

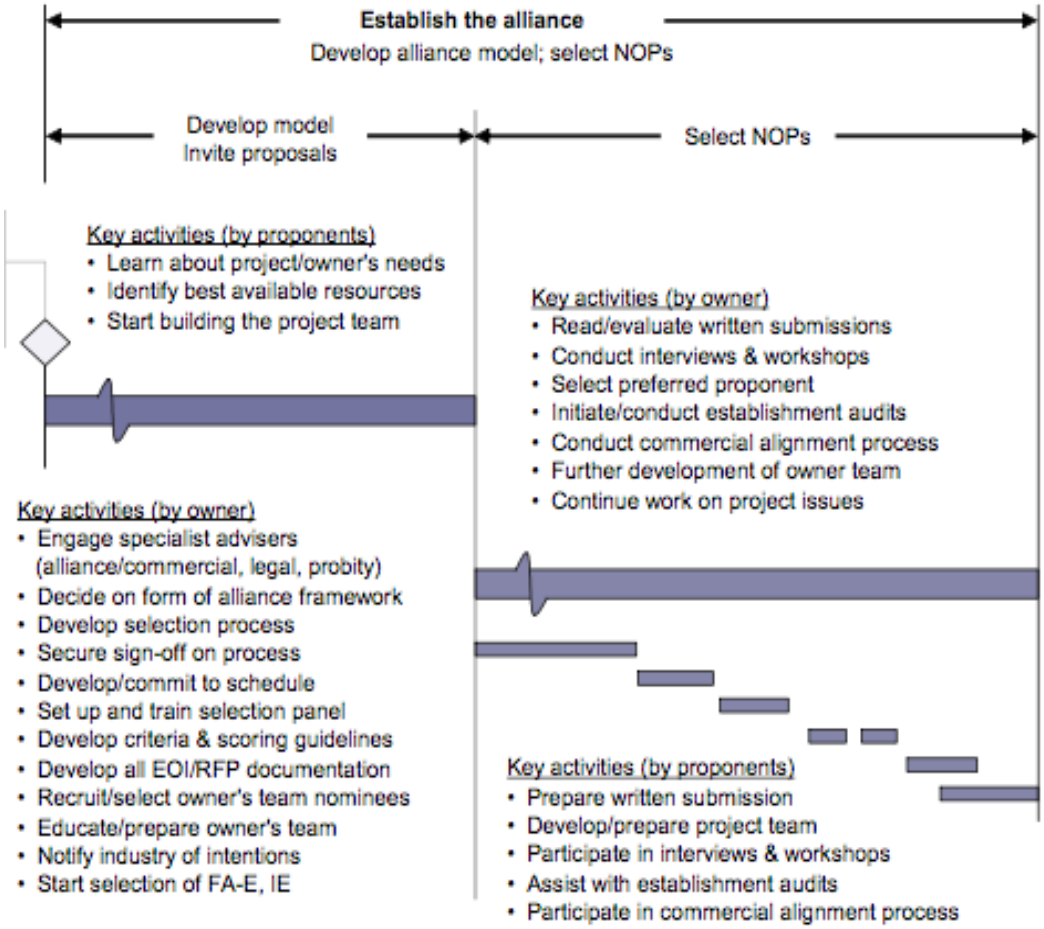

Figure 2. Framework in Establishing Alliance. (IUK, 2015)

2.7.2.1 Request for Proposal Development Stage

The RFP development stage is when the government having decide to form an alliance. Its evaluation and selection process issues the project details in which the participants are required to submit their proposals. Figure 3 below presents the steps leading to RFP stage.

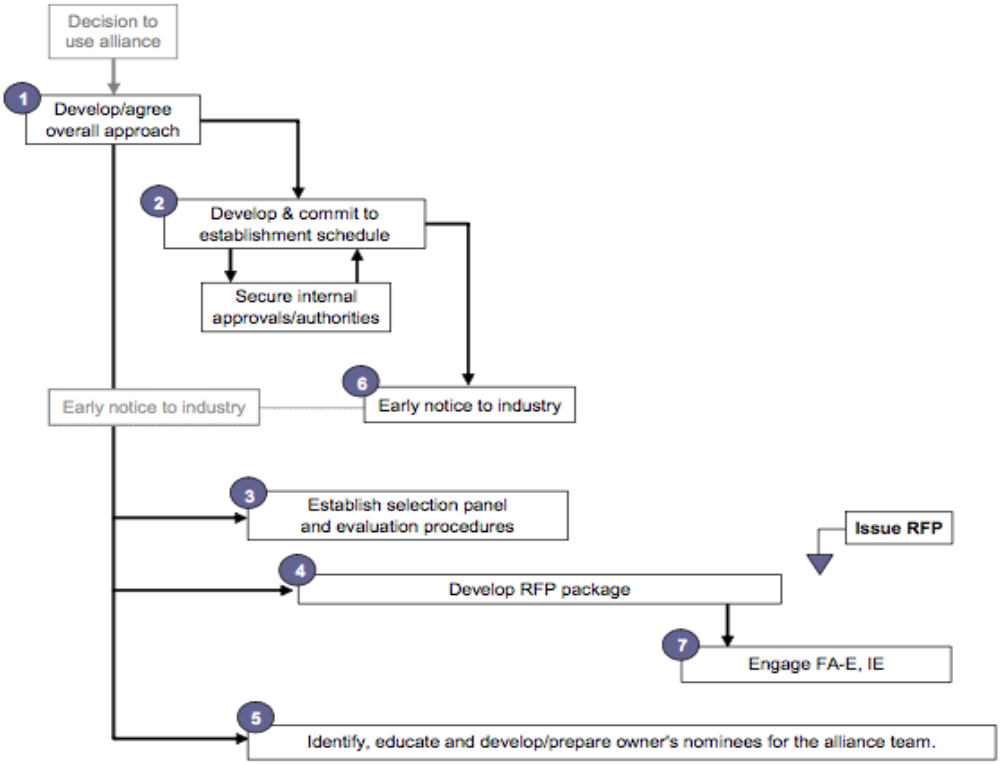

Figure 3. Steps Leading to RFP. (Ross, 2006)

Note: the duration of the stages may very depend on the situation.

2.7.2.2 Evaluation and Selection Process

The selection of project alliance as the suitable procurement method is one of the crucial decision the government has to make in the life cycle of the project alliance. Figure 4 shows below the selection and evaluation processes. The use of project alliance by the government provides numerous opportunities, but has more consequences than other form of procurement when used inappropriately. The selection process should process should be based on how to manage the potential risks and opportunities associated with the project compared to other procurement methods. (Commonwealth of Australian, 2015).

Project alliancing is mostly used on projects with the following characteristics

- Owner involvement in the project
- Very tight time frame
- Complex stakeholder issues
- Numerous unpredictable risk, uncertainties and complexity.
- Unclear output specification, risk of scope change during design or construction due to political influence, new innovation, environmental changes etc.
- Longer term projects

Alliancing is not suitable for projects where;

- The project scale is achieved using conventional method, however procurement cost may increase with the alliance method.
- Risks, scope, cost are clearly defined and allocated without the need of owner engagement.
- The project offers substantial straight-life opportunities and effectiveness, whereas unavailable with the alliance method.
- The current environment will not allow associated cultural and behavioral changes.

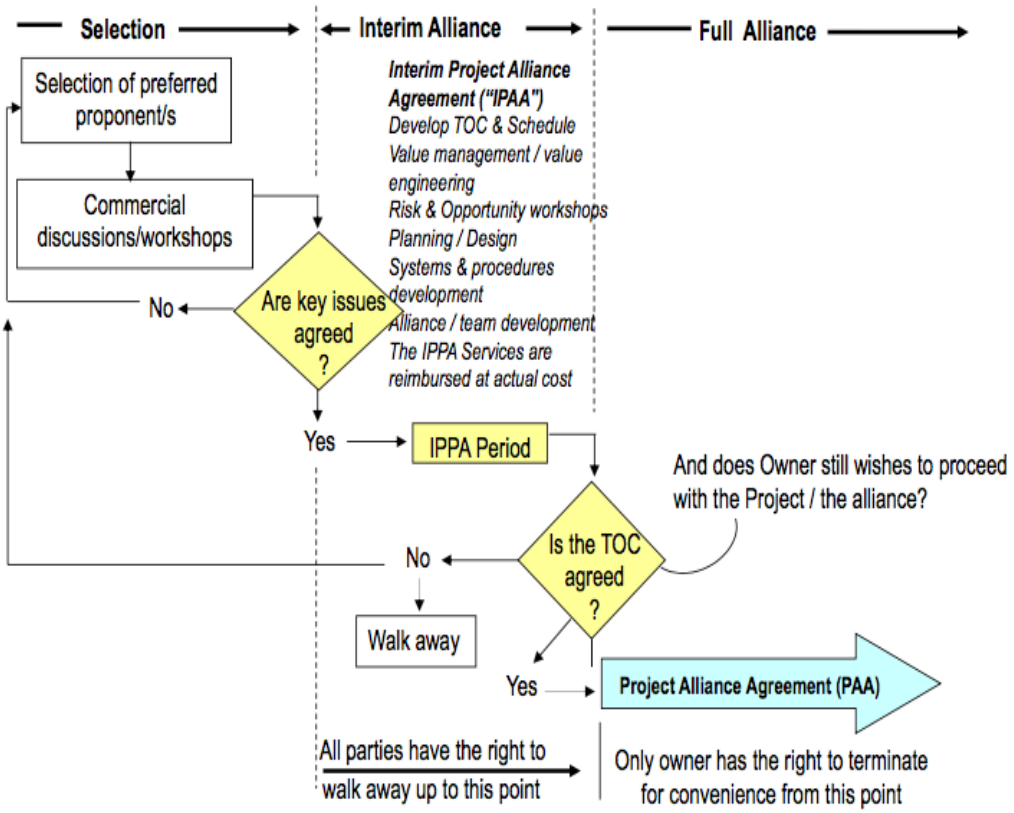

Figure 4. Selection and Evaluation Process. (Commonwealth of Australian, 2015)

Selection: the government must choose the suitable partners and then coordinate the overall framework and parameters for the alliance.

iPAA: Once the participants agree with the parameters, they enter into an interim Project Agreement (iPAA). This is where the NOPs are repaid their cost of work in an integrated team in pre-construction activities such as target schedule, development of TOC (Target Outturn Cost) and other cost for the project.

PAA: When the TOC and other cost are agreed on, the participants then enter into a full Project Alliance Agreement (PAA).

2.8 Alliance Management Structure

The project alliance participants work cooperatively together and operate as an implicit system/organization in trying to achieve the project outcome. In this situation, all participants commercial interest are aligned to meet or even exceed the project objective. Figure 5 presents the PAB and AMT managing framework.

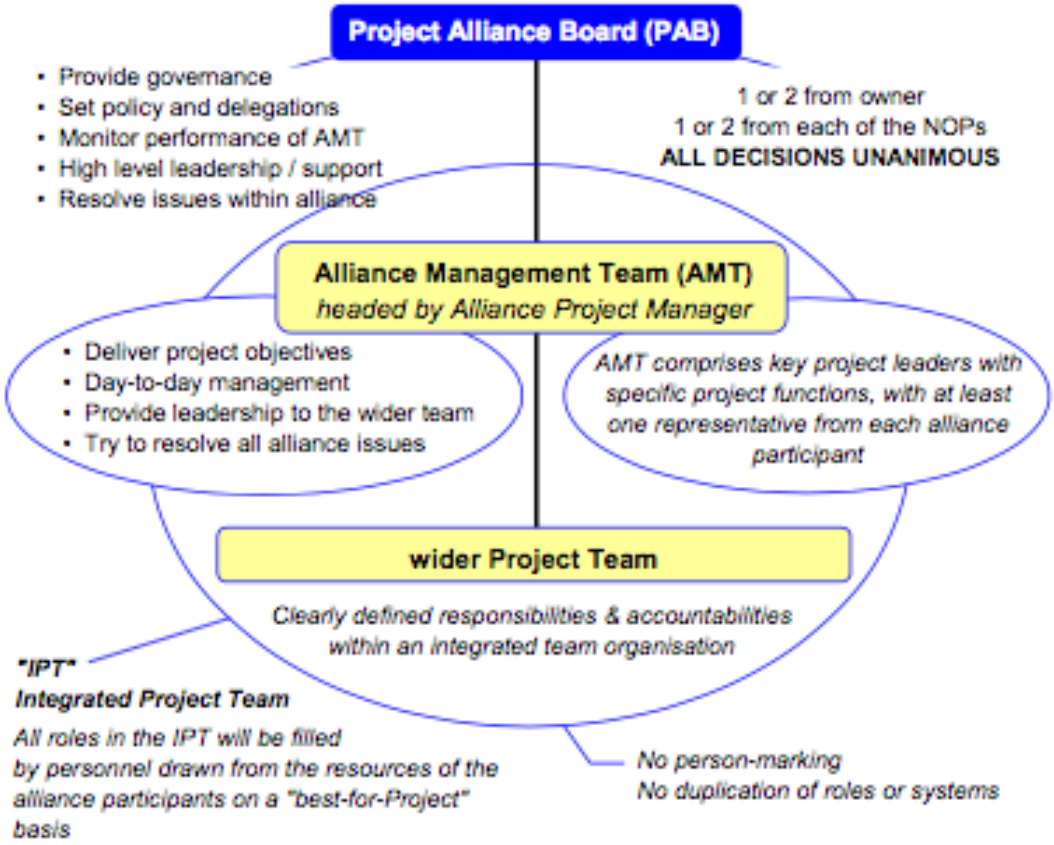

Figure 5. Typical Project Alliance Management Framework (Weatherall, 2013)

2.8.1 Alliance Leadership Team (ALT)

The alliance leadership team (ALT), also called alliance board, is comprised of an equivalent number of senior representatives from each party (Chen et. al., 2012). The ALT purpose is to provide leadership, oversight of the alliance, ensures achievement and objective and also governance. They meet on monthly basis to make decision best for the project. (Cock et. al., 2011).

2.8.2 Alliance Management Team (AMT)

The alliance management team (AMT) is responsible to handle the day-to-day management and leadership of the project (Gransberg, 2015). It was formed for that purpose (Mills et. al., 2014). The AMT members consist of top managers who are working on full-time basis (Cocks et. al., 2011)

2.9 Compensation Framework

The compensation framework under the Project Alliance Agreement (PAA) is the key structure for aligning the NOPs objectives with the project objectives. In this framework, the government and the NOPs scope and develop the project and unanimously agree on a performance cost and a target cost. The alliance partners therefore take on their collective duty for delivering the project along with the successfully reaching the agreed target, while sharing the financial pain or gain depending on the actual cost compared with the agreed target cost (Chen et al., 2010). Figure 6 presents the compensation framework and phases of project alliancing (Ross, 2006).

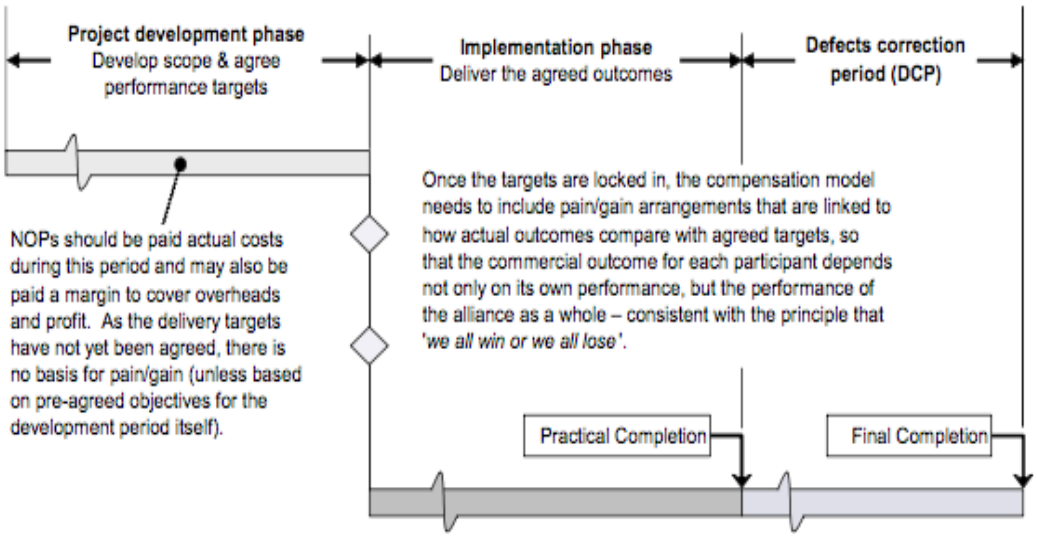

Figure 6. Compensation Framework and Phases of Project Alliancing. (Ross, 2006)

Once the performance target and target cost are established and agreed on, the NOPs are compensated during the delivery phase of the project in accordance with the following “3-limb model” as shown in Figure 7.

Limb 1: 100% of direct cost and indirect cost (overhead) are reimbursed

Limb 2: A fee to cover profit and corporate overheads.

Limb 3: A fair share of the pre-agreed pain/gain in between the participants depending on the actual outcome compared with the agreed pre-agreed target.

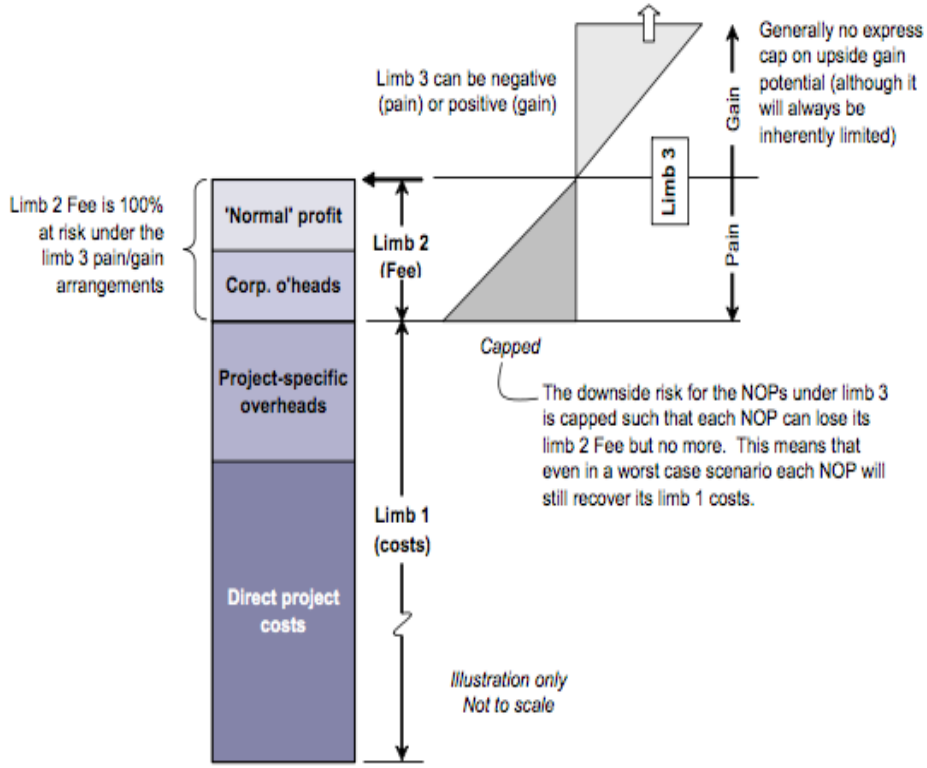

Figure 7. The 3-Limb Model. (Weatherall, 2013)

2.9.1 Target Outturn Cost (TOC)

During the interim Project Alliance Agreement (iPAA) the entire participants unanimously develop the target outturn cost. The TOC is the core of the compensation model and also used against the pre-agreed cost as the actual outturn

cost (AOC), which is used to determine the limb 2 fees (ADIT, 2011; Commonwealth of Australian) as shown in Figure 8.

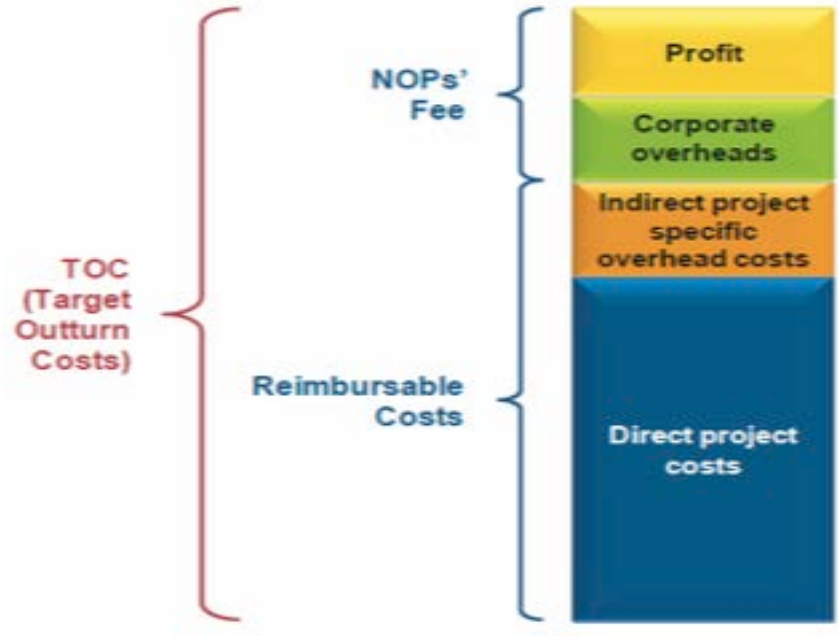

Figure 8. A TOC Structure (ADIT 2011)

2.9.2 Limb 1- Reimbursement of Project Cost

In this limb model, each NOP is reimbursed his actual cost of work on the project including project specific overhead cost. Hidden contribution to overhead or profit is not reimbursed in this model. All cost are subjected to audit and are 100% open book. (Chen et al., 2012; Gransberg, 2015).

2.9.3 Limb 2- Fee

This model involves a fee payment to the NOPs usually as fixed lump sum to cover their indirect cost plus a margin for profit. Actual outturn costs are incurred as a percentage as the fee. The fees are paid progressively in proportion to the participant's physical percentage completion (Commonwealth of Australian, 2015; Gransberg, 2015).

2.9.4 Limb 3- Sharing Pain and Gain

This model is intended to ensure a fair or equitable sharing of the financial pain or gain with the NOPs along with the government depending on the actual outcome compared with the pre-agreed targets which are the performance target and target cost. In the case of outcome results, it's a win-win or lose-lose. Cost overruns and underruns are shared 50:50 i.e. 50% to the owner and also 50% to the NOPs. Hosseinian & Carmichael, (2013), presented a model of the pain/gain as shown in Figure 9.

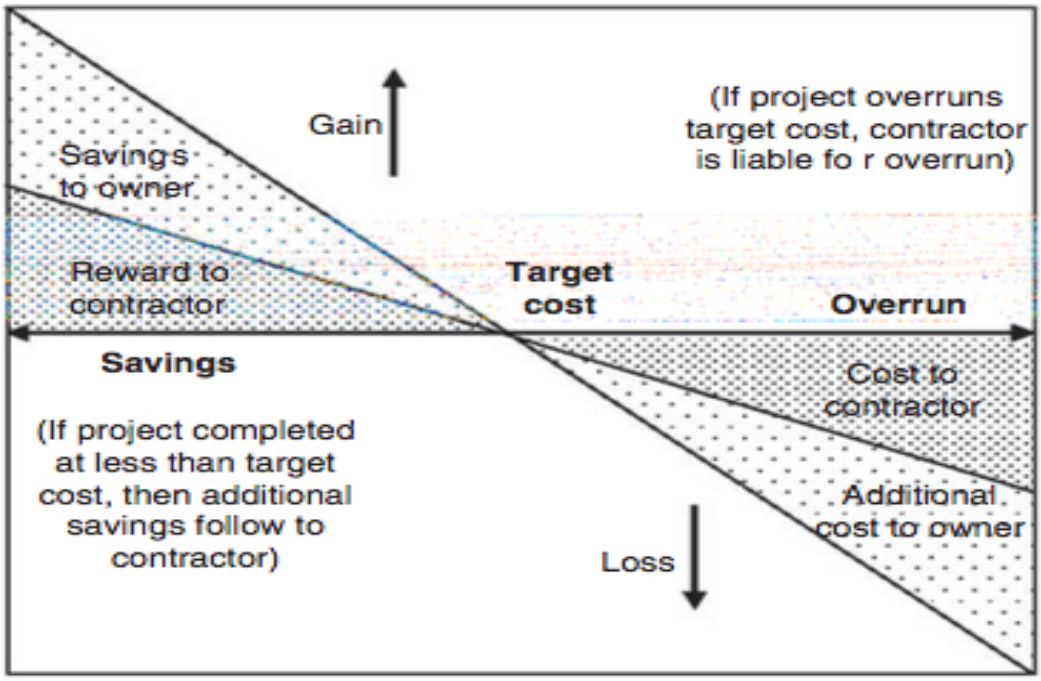

Figure 9. A Typical Pain/Gain Model. (Hosseinian & Carmichael, 2013)

2.9.5 Risk Allocation

Under the conventional form of contract, specific individual obligation from different parties and risk allocated to other party are generally considered best able to manage them. (Gransberg, Scheepbouwer & Loulakis, 2015). Figure 10 presents their characteristics. These are legal and commercial consequences when a party

functions poorly or are unsuccessful in fulfilling their requirement properly. Likewise, in the conventional approach the client/project owner tries to transfers as much risk as possible to the other parties (insurance companies, designers and contractors). Many more extreme examples of these adversarial conduct occur under the conventional contracting because clients/owners, when setting up the contracting agreement tries to transfers as much risk to other parties. It is now universally acknowledged that risk under a contract should be ensured by the party that is best able to regulate those risks (Commonwealth of Australian, 2015; IUK, 2014)

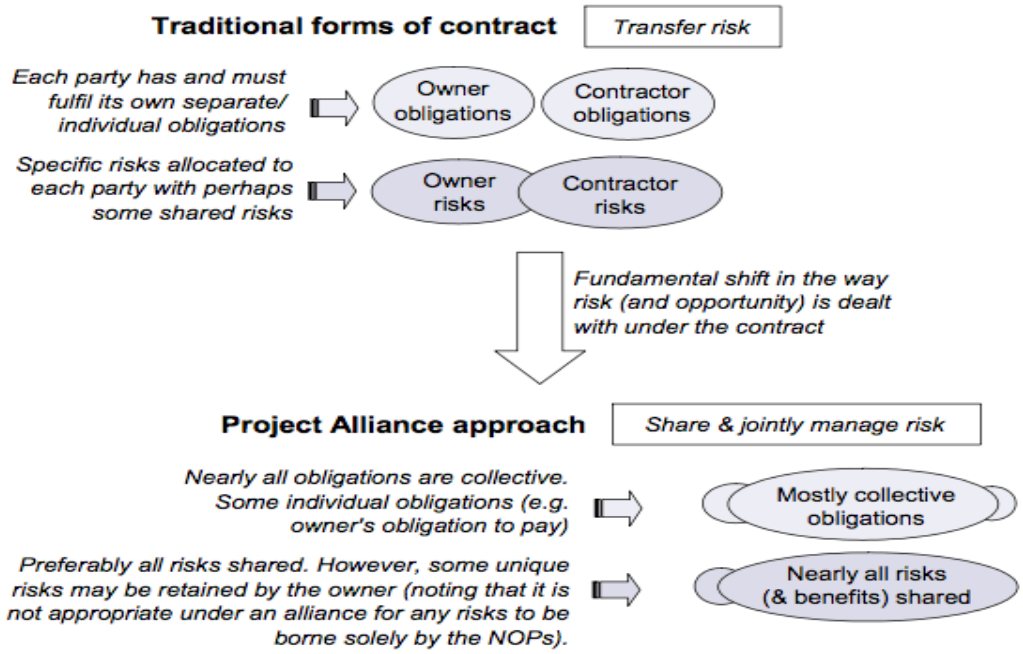

Figure 10. Characteristics of Tradition Contract and Project Alliance. (Ross, 2006)

Under project alliance, responsibilities and risk are shared are shared and managed jointly, instead of allocating to individual parties (ADIT, 2011). Target performance, including the target cost of the project (TOC) are established and set by the participants over the project development phase. Once the target performance is set, responsibilities and risk associated with the project delivery are assumed by the

alliance participants with equitable sharing of ‘pain or gain’ and also it depends on how the project result is compared with the pre-agreed targets. Despite the fact that opportunities and risk are collectively owned and are not directly related to the individual alliance participant’s performance, the quantitative impact of these benefits and risks are allocated through the pain/gain agreement. (Gransberg, Scheepbouwer & Loulakis, 2015, Ross, 2003) as shown in Figure 11.

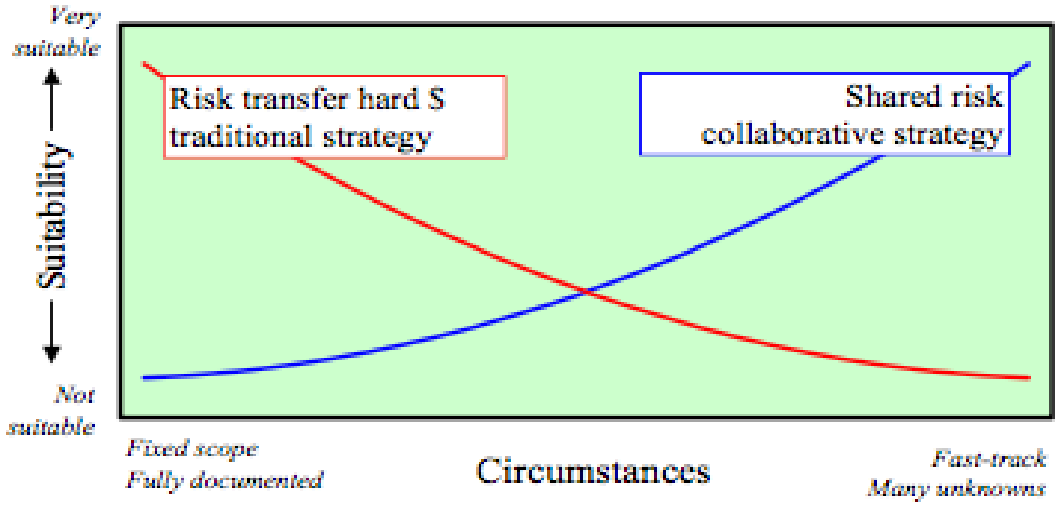

Figure 11. Risk Transfer of Tradition vs. Collaborative. (Gransberg et al., 2015)

Chapter 3

THEORETICAL FRAMEWORK

To build a concrete theoretical framework and gain perspective in what makes an alliance an alliance and why they are chosen as the project delivery method for those infrastructure projects. Thirty published articles within the last 16 years was analyzed and studied. Journal articles include from Australia, UK, China, Hong Kong, USA, Netherlands, Finland, Norway and New Zealand.

Furthermore, in this chapter project qualities and key elements of alliancing will be identified from literature alongside with success factor and barriers of alliancing.

3.1 Project Qualities

Not all infrastructure projects are suitable for the alliancing contracting (Henneveld, 2006, Morwood et al., 2008). However, some infrastructure projects have some key qualities which make them highly suitable for the alliancing approach.

The table below shows a list of project qualities suitable for alliance. They were extracted from the literature study and are arranged in a manner that attribute the selection of alliance based on the project qualities.

Table 1. Project qualities suitable for alliancing

Project Qualities	References
High Complexity	(Henneveld, 2006; Ross, 2006; Chen et al., 2010, 2012; IUK, 2014)
High Risk/ Uncertainties	(Ross, 2009; Chen et al., 2012; Commonwealth of Australia, 2015; Construction Agency Coordination Committee, 2015)
Tight Time Frame	(Henneveld, 2006; Ross, 2006; Chen et al., 2012; Commonwealth of Australia, 2015)
Complex Stakeholders	(Ross, 2006; Chen et al., 2012, Jefferies et al., 2014; IUK, 2014)
Scope Change/ Unclear Scope	(Ross, 2006; DTF Victoria, 2009; Love et al., 2010; Walker et al., 2015)
Complex Environment	(Jefferies et al., 2014; Construction Agency Coordination Committee, 2015)
Budget Constraints	(Henneveld, 2006; Chen et al., 2012)
Need for Owner Involvement	(Ross, 2003; DTF Victoria, 2009)
High Cost/ Large Project	(Love et al., 2010; Commonwealth of Australia, 2014; IUK, 2014; Jefferies et al., 2014)
New Innovation	(Ross, 2006; Rowlinson et al., 2006)
Long Term	(IUK, 2014)

Usually, when determining the PDM of a project many factors are taken into consideration. For instance, according to Jefferies et al. (2014), The Queensland State Government use Alliance or Partnering as default contract on both their Public works and Main Road department projects with construction period of more than 12 months as well as project cost estimate of A$10million ($750,000).

All the project qualities identified in the table above will be briefly described below. Note should be taken as all the project qualities were identified from literature as being a reason for alliance or per say suited for alliancing. However, an explanation as to why alliance suits the particular qualities was never mentioned in the literature.

3.2 Elements of Alliance

The elements of alliancing where all extracted from the literature. Nearly all of the literature and document on alliancing gave a definition on alliancing. It was from the

different definitions from different researchers that these elements where drawn out. A few elements were more effectively identifiable than others. For instance, Lahdenperä (2012) indicate the cases of directly specifying the elements. The cases gave a decent beginning stage from which the rundown of the elements could be extended.

Table 2. Some elements of project alliance (Lahdenpera, 2012; Yeung et al., 2007)

Elements of Project Alliancing	
Contractual/Hard Elements	• Formal Contract
	• Pain share/Gain share real arrangement
Soft Elements	• Trust
	• Long-term Commitment
	• Communication and Cooperation
Other Elements	• Alliancing Workshops
	• Win-win Philosophy
	• Objectives and Common Goal
	• Equity
	• Agreed Issues Resolution Techniques
	• Early Selection of Contractors

From there on, analysis of case studies in literature and cross- referencing them brought about the elements shown in Table 3. The elements were arranged as identified from the document study.

Table 3. Alliance element from literature

Elements of Alliance	**Cited by Authors**
Open Book Approach	(Henneveld, 2006; Rowlinson et al., 2006; Chen et al., 2010; Haugseth, 2014)
No Blame/ Dispute	(Henneveld, 2006; Chen et al., 2010; Walker et al., 2015, Gransberg et al., 2015)
3- Limb Model	(Ross, 2006; ADIT, 2011; Weatherall, 2013; Chen et al., 2010; Sommerville et al., 2010)
Target Outturn Cost (TOC)	(ADIT, 2011; DTF, 2015; Sommerville et al., 2010)
Pain/Gain Share	(Weatherall, 2013; IUK, 2014; Hosseinian & Carmichael, 2013, Haugseth, 2014)
Risk/Reward Sharing	(Ross, 2006, Love et al., 2010; Commonwealth of Australian, 2015; Sommerville et al., 2015).

Table 3 (cont.)

Auditing	(Ross, 2003; Commonwealth of Australian, 2015)
Collaboration	(Sakal et al., 2005; Bourne & Walker, 2008; Mills et al., 2014)
Common Goal	(Ross, 2003; Rooney, 2009; Walker et al., 2013; Commonwealth of Australian, 2015)
Joint Responsibility	(Ross, 2006; Sakal et al., 2005; DTF, 2009, IUK, 2014)
Unanimous Decision	(DTF, 2009; IUK, 2014; Mills et al., 2014)
Incentive Cost Reimbursement	(Ross, 2003; Cock et al., 2011; Walker et al., 2013)
Alliance Leadership Team	(Ross, 2006; Henneveld, 2006, Cock et. al., 2011).
Alliance Management Team	(Chen et. al., 2010; Cocks et. al., 2011; Mills et. al., 2011)

3.3 Success Factors and Barriers

Success factors and Barriers gives understanding into what factors to consider while choosing alliancing as the PDM and what to consider when going into an alliance agreement.

3.3.1 Success Factors (SF)

For the Success Factors, when reviewing the article of Jefferies et al. (2014), they identified seventeen SF from literature and add five more from the analyses of a case study.

Table 4. Critical success factors (Jefferies et al., 2014)

Critical Success Factors	
▪ Trust between parties	▪ Facilitate on-going workshops
▪ Equity	▪ Sound relationship
▪ Mutual goals and Objectives	▪ Stretch targets
▪ Commercial incentive	▪ Alliance structure
▪ Shared knowledge	▪ Joint process evaluation
▪ Flexibility and adaptability	▪ Tight alliance outline
▪ Open communication	▪ Facilitation
▪ Cooperative spirit	▪ Best people for project
▪ Integration of a web-based management programme	▪ Strong commitment by client & senior management

Strong commitment by client & senior management, Trust between parties, Mutual goals and Objectives, Cooperative spirit, Best people for project, Open communication, Facilitation and Shared knowledge were all stated by Haque et al (2004) and Walker & Hapson, (2008).

Equity, Commercial incentive, Joint process evaluation and Stretch targets were also mentioned by Green & Lenard, (1999) and Jefferies et al, (2001).

However, Love et al. (2010) mentioned that among those identified SFs, Trust, Open Communication, Creativity, Adequate Resources, Goal alignment and Coordination are the most common factors, but did not explain why.

3.3.2 Barriers

Amid the research, it turned out to be evident that alliancing is not a suitable PDM for all infrastructure projects and various factors ought to be considered. Rahat (2014) and other researchers reported to have found 18 barriers for alliancing.

Table 5. Barriers for adoption of alliance.

Barriers for Alliancing	**References**
No Clear policy toward alliance	Ning & Ling, (2013); Rahat, (2014)
Accountability concerns	Rahman & Kumaraswamy, (2008); Ning & Ling, (2013); Ling et al, (2014)
Operational problems	Eriksson et al, (2008); Ning & Ling, (2013); Rahat, (2014)
No standard framework for alliance	Ning & Ling, (2013); Rahat, (2014); Ling et al, (2014)
Friction between alliance	Ning & Ling, (2013); Rahat, (2014)
External influences	Man & Royakkers, (2009); Rahat, (2014)
Not a priority	Hertogh et al, (2008); Rahat, (2014)
Backlashes of the experiment	Man & Royakkers, (2009), Rahat, (2014)
Complex observability	Eriksson et al, (2008), Rahman & Kumaraswamy, (2008)
Lack of project team motivation	Ning & Ling, (2013); Ning, (2014); Rahat, (2014)

Table 5 (cont.)

No systematic development process	Man & Royakkers, (2009); Ling et al, (2014); Ning, (2014)
Not suiting organization culture	Rahman & Kumaraswamy, (2008); Ning, (2014); Ling et al, (2014)
Lack of alliance promotion	Eriksson et al, (2008), Rahat, (2014)
Unforeseen steps	Ning, (2014), Ling et al, (2014)
Lack of investment Knowledge	Ning & Ling, (2013); Ning, (2014); Ling et al, (2014); Rahat, (2014)
Shortage of personnel	Hertogh et al, (2008); Ning, (2014); Rahat, (2014)
Lack of enough leadership	Eriksson et al, (2008); Ning & Ling, (2013)
Lack of champions	Man & Royakkers, (2009); Ling et al, (2014); Rahat, (2014)

A total of 18 barriers were identified from the literature. Some of the literatures such as Eriksson et al, (2008), Ning & Ling, (2013) and Ling et al, (2014) gave their respective barriers factors as general to all the relational contracting types.

Chapter 4

METHODOLOGY

This section describes in detail the research methodology employed in this study, as well as the methods of collecting and analyzing the data obtained and also limitations.

4.1 Data Collection

A comprehensive literature review was primary sources. While the survey questionnaire was the secondary. The research questions were addressed by an extensive literature and document study of articles and publications mostly from Australia and other countries. Furthermore, scholarly articles, conference papers and documentations from industry and government association were also reviewed (Alliance Best Practice in Infrastructure Delivery, National Alliancing Contracting Guidelines).

The results obtained from the semi-structured questionnaires will be compared and contrasted with the finding from the literature and document studies. The questionnaire was completed by industry professional with experience in recently completed large infrastructure projects.

4.1.1 Choosing a Respondent

The choosing of the respondents was restricted by two criteria's:

1. In order to guarantee having the significant experience and the capacity to contribute to the research topic the respondents should have been involved in

complex infrastructure projects. Technical aspects, interdependencies and uncertainties found in different documents and literature were used as main component to define a complex infrastructure project. Respondents from any sector should be familiar with the complexity element listed in the study.

2. Each respondent need to acquire a general background knowledge of different industries such as highway construction, bridge construction, water supply, power plants etc. to get many sides about the characteristics and complexities in infrastructure projects.

With the survey questionnaire, respondents experience and thoughts would be perceived which will broaden the study further. Once the benchmark was set, a list of respondents from consultancy and construction firms who were currently or involved in the successful completion of a complex infrastructure project was formed. This was based on official and personal contacts and the selection method introduced was neither comprehensive nor randomized.

However, time, distance and the availability of respondents became a constraint. Brief outline of the research was emailed to the respondents requesting them to participate.

4.1.2 Survey Questionnaire I

A semi-structured questionnaire was prepared containing factors which might or might not bring about complexity in projects. The questionnaire was a 5 point Likert Scale type, respondents were asked to express how much they agree or disagree with the factors according to their understanding and experience. Also, they were asked if all the complexities addressed by the selected PDM in their projects. The questionnaire was sent to construction firms and public sectors (Qumecs Nig. Ltd

and Ministry of Works Kano) having project management experience. An online version was prepared to encourage a higher rate of response. (A sample questionnaire is attached in Appendix A)

4.1.3 Survey Questionnaire II

The second questionnaire was tested on real life alliance case studies. This was done as a way to verify and clarify the results obtained from our primary source (i.e. the literature). The alliance qualities, elements, success factors and barriers identified by the research do in fact exist in the real-life alliance projects.

The questionnaire was made up of questions to identify Qualities, Elements, Success Factors and Barriers identified by the literature with their corresponding alliance projects and was emailed to them. (A sample questionnaire is attached in Appendix B).

Firstly, respondents were asked about project name, their role in the project, size of the project in term of cost, number of alliance parties and duration. The next question was to identify some project qualities that influenced their selection of alliancing as the PDM. For the third question respondents were ask to tick for each element whether it was present in their alliance project and also alliance in general. Towards the end, they were given a chance to add other elements that they ought to be incorporated. The fourth and fifth questions was a list of identified success factor (SF's) and barriers of alliancing in which respondents were ask rate them from strongly disagree to strongly agree. And also add other factors which they experienced.

4.1.3 Respondents

Contact was made with aid of some professors from the Monash University of Australia where we came in contact with of PMs from award winning construction firm such as GHD, Abigroup now known as (Lendlease), BMD Constructions, Seymour Whyte Group and SMEC with first-hand experience on alliance projects been involved in a successful completion large scale infrastructure projects in Australia. Also with their help participants were also acquires from Finland. An email was sent to each contact and were ask to for their assistance in filling out a short questionnaire regarding their alliance projects. Out of the 7 participants in Finland 5 responded.

Respondents completed the survey resulting in six case studies both in Australia and Finland. Four from Australia; The Bulk Water Alliance, Go Alliance, Origin Alliance and Safelink Alliance. The remaining two case studies from Finland where; Kokemaki Alliance and Rantatunneli Alliance. Table 6 gives each participants demography.

Table 6. Participants demography

Participants No.	Organization Representing	Role	Years of Experience	Case Projects
1	SMEC	Asst. PM	5	Go Alliance
2	BMD Const.	PM	6	Go Alliance
3	GHD	PE	13	Bulk Water Alliance
4	Abigroup	PM	4	Bulk Water Alliance
5	Seymour Whyte	Asst. PM	5	Bulk Water Alliance
6	BMD Const.	AM	6	Safelink Alliance
7	ACTEW	Consultant	8	Bulk Water Alliance

Table 6 (cont.)

8	BMD Const.	Asst. PE	6	Safelink Alliance
9	BMD Const.	DM	4	Safelink Alliance
10	Abigroup	Senior PM	8	Origin Alliance
11	Seymour Whyte	Senior PE	7	Origin Alliance
12	SMEC	Asst. PE	6	Origin Alliance
13	Vison Oy	Senior PM	4	Kokemaki Alliance
14	Vison Oy	PM	4	Kokemaki Alliance
15	Vison Oy	Asst. PM	3	Kokemaki Alliance
16	Lemminkäinen Group	Asst. PE	4	Rantatunneli Alliance
17	Lemminkäinen Group	Senior PM	4	Rantatunneli Alliance

Table 7 gives the alliance case project detail description, the alliance name, its value, no. of participants (both owner and NOPs), duration, project type and its location.

Table 7. Details of alliance projects case study

Alliances	**Value ($)**	**No. of Participants**	**Duration (Years)**	**Project Type**	**Location**
Kokemaki Alliance	118.9M	3	4	Railway	Finland
Go Alliance	$148M	4	3	Highway	Australia
Rantatunneli Alliance	$202M	5	5	Tunnel	Finland
The Bulk Water Alliance	$306M	5	6	Water Supply	Australia
Safelink Alliance	$1.34B	5	3	Highway	Australia
Origin Alliance	$1.45B	6	4	Highway	Australia

4.2 Limitations

The greatest limitation for this situation was distance. This implied the alternative of in person interview was not feasible at this stage of this research process. This showed the constraints with the survey questionnaire in terms of limited amount of information could be conveyed.

4.3 Method of Analysis

The method of analysis used for the study are Survey Monkey and Microsoft Excel. The survey monkey was used to collect the responses of the questionnaire filled by the respondents and analyze the responses in form of tables and charts. While further analysis would be done using the Analysis Tool pack in Excel. With the Microsoft Excel the mean, median, mode and standard deviation would be produced.

4.3.1 Data Coding

Data coding is the input data to be used for the study in my case is from a questionnaire data and it is to be analyzed. The first and foremost step is the data coding. Transforming the questionnaire into another format to compute (in this case using Microsoft Excel). The questionnaire data are converted into numbers one for each of value.

4.3.2 Descriptive Statistics

When the questionnaire data that has been coded one number for each value. The next is the descriptive statistics which gives a brief description coefficient which summarizes the given data set. It also describes the basic features of the data in the study. It forms the basis of virtually every quantitative analysis of data.

They are broken down into measure of variability and measurement of central tendency while the measure of tendency is the mean, median and the measure of variability is the standard deviation or variance.

Chapter 5

DATA ANALYSIS AND FINDINGS

In this section, a step by step analysis using the Microsoft Excel will be shown and how the results are being emerged. The research will then focus on some key data collected during the process. The collection would be done through a simple descriptive quantitative analysis through the questionnaire and section-wise analysis was done to facilitate understanding, key finds will be examined and correlated to the findings from the literature. Finally, a conceptual framework model will be formed with its managerial implications.

5.1 Sector-Wise Analysis

Each participant for the survey were from different construction sectors such a bridge, highway, tunnel, Water supply etc. Out of 40 questionnaires sent to the respondent, 25 responses were acquired. Of the 25 acquired responses, 4 responses were invalid because there were not categorized as an infrastructure project which this study is based on leaving a total of 21 valid response. Endeavor was made to classify the response sector-wise and then analyze them to make sure and check whether each factor judgment varied across the sectors. Table 8 below shows the response count for each project type and also Figure 12 shows the sector distribution of the respondents.

Table 8. Response table

Project Type	Response Percent	Response Count
Airport	0.0%	0
Highway	52.4%	11
Bridge	19.0%	4
Tunnel	23.8%	5
Rail	0.0%	0
Dam and Reservoir	0.0%	0
Power Grids	0.0%	1
Water Supply	4.8%	0
Telecommunication	0.0%	2
Answered question		21

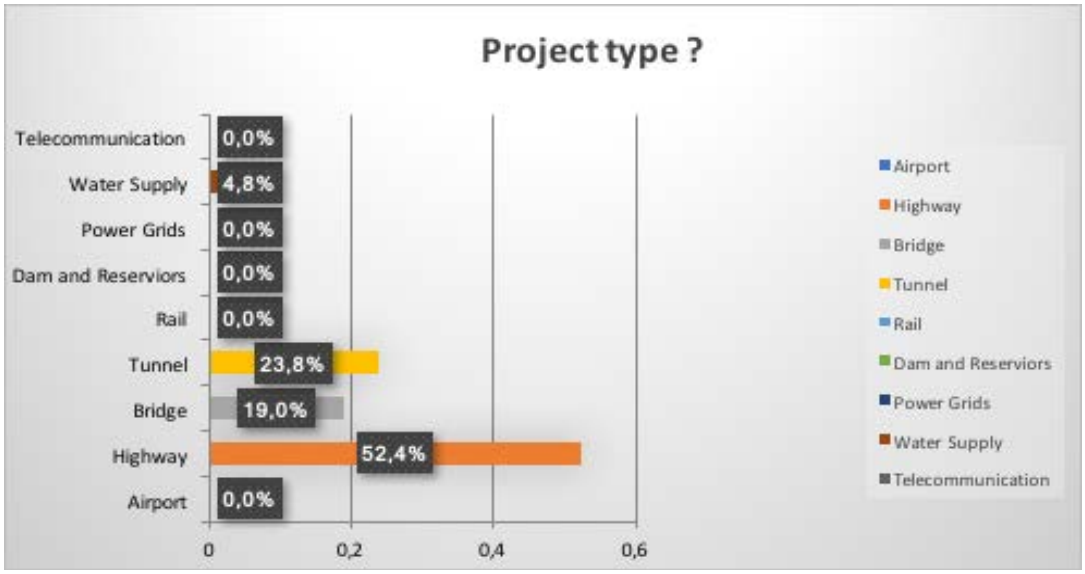

Figure 12. Sector-wise Distribution

5.2 Quantitative Analysis I

The quantitative analysis conducted to test the data and check for similar pattern on a slightly broad scope. Main goal was to pinpoint the data for more prominent consistency. The short questionnaire on project complexities was sent to various Project Manager in different industry as cross different sectors to gain more insight as to what adds to projects complexity. The respondents were asked to evaluate each factor and express their level agreement on the 5-point Likert scale whether these factors cause complexity in project or not.

With a total of 21 responded questionnaires, this cannot be a representative of the whole population but the small sample size did create a quick outcome. Also, due to resource, distance and time constraints in this research, the data was interpreted based on this small size.

The data in Microsoft Excel was tabulated for each respondent vs each factor. The value for each point in the Likert scale is shown in Table 9:

Table 9: Value table

Strongly Disagree	1
Disagree	2
Neither Disagree nor Agree	3
Agree	4
Strongly Agree	5

5.2.1 Project Complexities

A rundown list of factors that contributes to project complexity as identified in literature. Table 10 presents the cumulative results as answered by the respondents.

Table 10. Frequency table

	Strongly Disagree	**Disagree**	**Neither Disagree nor Agree**	**Agree**	**Strongly Agree**
High Complexity	0%	24%	10%	43%	24%
High Risk/ Uncertainties	0%	19%	10%	48%	24%
Tight Time Frame	0%	24%	24%	33%	19%
Complex Stakeholders	0%	5%	15%	60%	20%
Scope Change/ Unclear Scope	0%	19%	5%	43%	33%
Complex Environment	0%	5%	5%	62%	29%
Budget Constraints	0%	14%	24%	43%	19%
Need for Owner Involvement	10%	5%	52%	33%	0%
High Cost/ Large Project	0%	15%	15%	25%	45%
New Innovation	10%	25%	15%	35%	15%
Long Term	10%	28%	28%	28%	11%
Environmental Challenges	0%	0%	0%	47%	53%
Shortage of Resources	0%	0%	13%	87%	0%
Need for Flexibility	0%	0%	27%	53%	20%
Overlap Phases or Concurrency	0%	47%	0%	40%	13%
High Degree of Technology	0%	33%	20%	20%	27%
High Level of Interdependencies between Processes	0%	7%	0%	67%	27%
Unsuitable Contract for the Project Type	0%	47%	47%	7%	0.0%
Cultural Differences	0%	27%	47%	27%	0%
Communication between different part of Organization	0%	0%	0%	73%	27%

From the examination of the entire sample, there were some intriguing connotations that were drawn from the table:

- Most respondents agreed on shortage of resources a major factor in complexity (87%), this shows there can never be abundant of resources in a project.
- High percentage of the respondents agreed with ‘High level of interdependencies between process’ (67%) could cause project complexity.
- Similar response of (62%) and (53%) to factors like ‘Complex environment and Environmental challenges respectively force changes in the project and add up to project complexity.
- Trailing behind closely is ‘Complex stakeholder issues’ (60%).
- Factors like ‘High risk/uncertainty, Tight time frame, Budget Constraint, Need for owner involvement’ were oddly distributed across showing their contribution to complexity depends on the particular project.

As seen in the frequency table, there might be considerable measures of differential response. This led to an additional check for the median, mean and standard deviation for each factor which is shown is Table 11. With the standard deviation, it indicated the variation in the size of the response, in other words factors with a high standard deviation implies several respondents feel differently about that particular factor.

Table 11. Median, mean and standard deviation for each factor

	Median	**Mean**	**Standard Deviation**
High Complexity	4.00	3.67	1.08
High Risk/ Uncertainties	4.00	3.76	1.02
Tight Time Frame	4.00	3.48	1.05
Complex Stakeholders	4.00	3.95	0.74
Scope Change/ Unclear Scope	4.00	3.90	1.06
Complex Environment	4.00	4.14	0.71
Budget Constraints	4.00	3.67	0.94
Need for Owner Involvement	3.00	3.10	0.87
High Cost/ Large Project	4.00	4.00	1.10
New Innovation	3.50	3.20	1.25
Long Term	3.00	3.11	1.10
Environmental Challenges	5.00	4.53	0.50
Shortage of Resources	4.00	3.87	0.34
Need for Flexibility	4.00	3.93	0.68
Overlap Phases or Concurrency	4.00	3.20	1.17
High Degree of Technology	3.00	3.40	1.20
High Level of Interdependencies between Processes	4.00	4.13	0.72
Unsuitable Contract for the Project Type	3.00	2.60	0.61
Cultural Differences	3.00	3.00	0.73
Communication between different part of Organization	4.00	4.27	0.44

Respondents even agreement put together for each factor is portrayed by the mean. Despite the fact that factors like ‘Need for Flexibility’ has a high mean but a low value in frequency table. This value portrays a great number of respondents agreed that this factor has the tendency to lead to project complexity. The standard deviation also builds up the fact for this factor having the lowest of (0.68), which shows the deviation is very limited in the response.

Then again, a factor like ‘New Innovation’ has a mean value of 3.20, which shows that majority of the respondent are not certain about this factor, whether it may to lead complexity in projects or not. However, based on the information given by standard deviation of the factors which is the highest at 1.25, the mean value alone is

not giving the right image because obviously there is a variation in response. However, average score of each factor is drawn as shown in Figure 13.

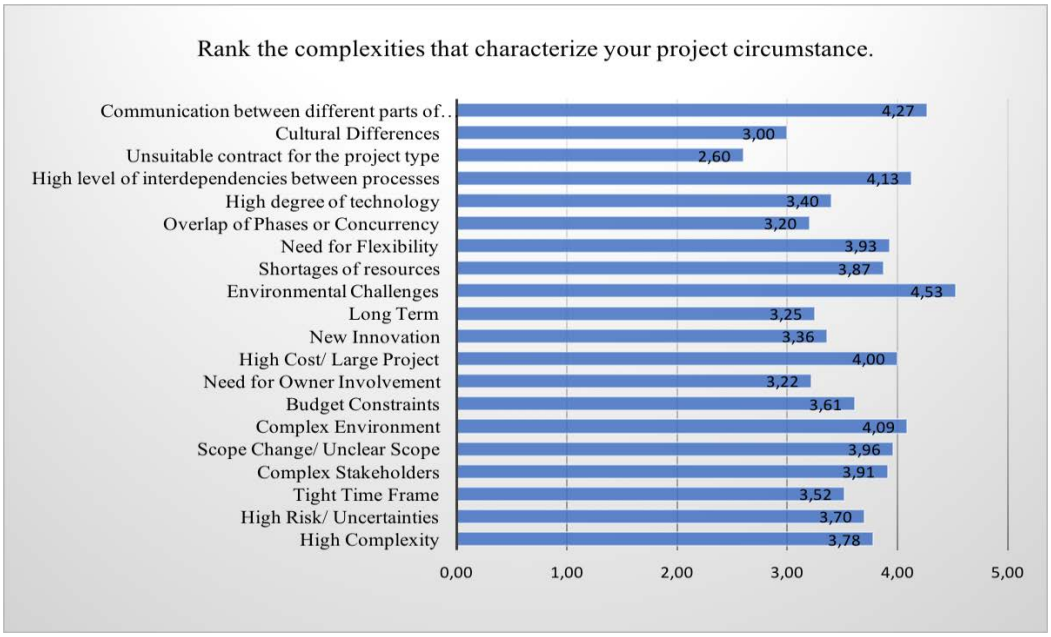

Figure 13. Average Score for Each Factor

5. 3 Quantitative Analysis II

While the Quantitative Analysis I was for project complexities, the Quantitative Analysis II is for the main research topic which is Alliancing. The analysis was on the qualities of alliance project, elements of alliance, success factors and barriers. The objective was to pinpoint the data for better consistency and verifying the results obtain from literature on alliancing really do exist in the real-life alliance projects. The data was also collected through a questionnaire sent to various PMs from Australia and Finland across different sectors.

Target respondents were chosen from Australia and Finland because alliancing is highly practice in those locations. About 60% of their infrastructure projects are

delivered through the alliance model, making them a suitable target for a rich data collection for this study.

The questionnaire sent contained a total of 9 questions with a list of factors assumed to be qualities of alliance projects, elements of alliance, its success factors and barriers. The same 5 point Likert-scale was also used to get the respondents experience and agreement. But for the alliance elements they were asked to tick the elements irrespective whether present in their project and also present in the alliance model in general.

A total of 17 PMs responded to the questionnaire. The sample size was relatively small but quick results where produced. However, with this sample size it cannot be a representative of other findings and circumstance, as a result, the outcome cannot be precise and impeccable. The interpretation of the data based on the small sample size was due to time, distance and resource constraint.

The same analysis was used as in Quantitative Analysis I for project complexities. For this study, it is assumed that collected data is not ordinary in nature and the scale used has equal spaced intervals. For this reason, median, mean and standard deviation are valid for these data.

Tabulated data in Excel for each respondent vs each element. The Likert-scale were same as in Quantitative Analysis 1. Table 8 below presents the table.

5.3.1 Project Qualities

A rundown list of factors that are assumed to be qualities of a project suitable for alliancing as identified in literature. The Table 12 presents the cumulative results as answered by the respondents.

Table 12. Frequency table

	Strongly Disagree	**Disagree**	**Neither Agree nor Disagree**	**Agree**	**Strongly Agree**
High Complexity	0%	0%	0%	18%	82%
High Risk/ Uncertainties	0%	0%	0%	12%	88%
Tight Time Frame	0%	0%	6%	53%	41%
Complex Stakeholders	0%	0%	0%	13%	88%
Scope Change/ Unclear Scope	0%	0%	0%	29%	80%
Complex Environment	0%	0%	0%	12%	88%
Budget Constraints	0%	0%	0%	65%	35%
Need for Owner Involvement	0%	0%	6%	6%	88%
High Cost/ Large Project	0%	0%	0%	18%	82%
New Innovation	0%	0%	0%	0%	100%
Long Term	0%	0%	12%	42%	48%
Need for Flexibility	0%	0%	0%	53%	47%
Environmental Challenges	0%	0%	0%	0%	100%
Shortage of Resources	0%	0%	6%	47%	48%

From the analysis of the project qualities, there are some fascinating result drawn from the table above;

- All respondents (100%) agreed on the factors ‘New Innovation’ and ‘Environmental Challenges as been one of alliance project qualities.
- Factors such as High Complexity, High Risk/Uncertainty, Complex Stakeholders, Scope Change/Unclear Scope, Complex Environment, Need for Owner Involvement and High Cost/Large project are all either 80% and above. This shows that all these factors are part of project qualities that influence the selection of alliance as the PDM.
- Similar response to factors like Tight Time Frame, Budget Constraints, Long Term, Need for Flexibility and Shortage of Resources indicates that these factors might influence the selection of alliance as the PDM.

They seem to be a little variation in the response from the frequency table bring about additional analysis by checking the mean and standard deviation for each factor. Table 13 below shows standard deviation of factors in the scale of response.

Table 13. Median, mean and standard deviation table

	Median	**Mean**	**Standard Deviation**
High Complexity	5.00	4.82	0.38
High Risk/ Uncertainties	5.00	4.88	0.32
Tight Time Frame	4.00	4.35	0.59
Complex Stakeholders	5.00	4.88	0.33
Scope Change/ Unclear Scope	5.00	4.71	0.46
Complex Environment	5.00	4.88	0.32
Budget Constraints	4.00	4.35	0.48
Need for Owner Involvement	5.00	4.82	0.51
High Cost/ Large Project	5.00	4.82	0.38

Table 13 (cont.)

New Innovation	5.00	5.00	0.00
Long Term	4.00	4.35	0.68
Need for Flexibility	4.00	4.47	0.50
Environmental Challenges	5.00	5.00	0.00
Shortage of Resources	4.00	4.41	0.60

As seen from the table above, all the factors have high mean values. This signifies nearly all of the respondents tends to agree that these factors influence the selection of alliance as the PDM.

The almost all the factors have a relatively low standard deviation, indicating that the mean values are portraying the real picture. The scores of each factor is drawn in Figure 14 below.

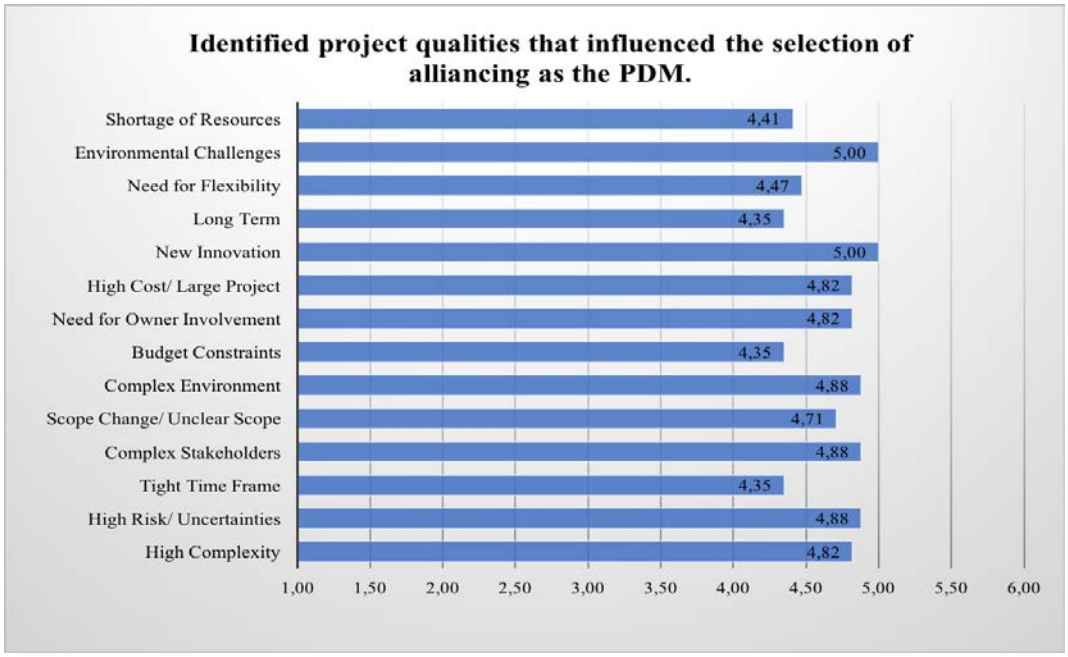

Figure 14. Average Score for Each Factor

5.3.2 Elements of Alliancing

The questionnaire had an exploratory run down of list of identified elements from the literature study that formed the basis. The PMs were to identify the elements present in their respective alliance and general in Alliance. The Table 14 bellow shows the result.

Table 14. Element frequency

	Present in Alliance Project	**Alliance in General**
Open Book Approach	100%	100%
No Blame/Dispute	100%	100%
3-Limb Model	100%	100%
Target Outturn Cost (TOC)	100%	100%
Pain/Gain Share	100%	100%
Risk/Reward Sharing	100%	100%
Auditing	100%	100%
Collaboration	100%	100%
Common Goal	100%	100%
Joint Responsibility	100%	100%
Unanimous Decision	100%	100%
Incentive Cost Reimbursement	80%	100%
Alliance Leadership Team	100%	100%
Alliance Management Team	100%	100%

The result obtained based on respondent's experience helped to validate the identified elements in the literature as shown in Table 15. All elements were present in all alliance projects except 'Incentive Cost Reimbursement'. 5 out of the 17

respondents did not tick for that particular element and were all from Finland. But the reason as to why it was not selected as an element of alliancing is unknown, showing the downside of the questionnaire data collection method.

Table 15. Questionnaire case study result

Elements of Alliance	**GO ALLIANCE**	**KOKEMAKI ALLIANCE**	**ORIGIN ALLIANCE**	**RANTATUNNEL**	**SAFELINK ALLIANCE**	**THE BULK WATER**
Open Book Approach	X	X	X	X	X	X
No Blame/ Dispute	X	X	X	X	X	X
3-Limb Model	X	X	X	X	X	X
Target Outturn Cost (TOC)	X	X	X	X	X	X
Pain/Gain Share	X	X	X	X	X	X
Risk/Reward Sharing	X	X	X	X	X	X
Auditing	X	X	X	X	X	X
Collaboration	X	X	X	X	X	X
Common Goal	X	X	X	X	X	X
Joint Responsibility	X	X	X	X	X	X
Unanimous Decision	X	X	X	X	X	X
Incentive Cost Reimbursement	X	0	X	0	X	X
Alliance Leadership Team	X	X	X	X	X	X
Alliance Management Team	X	X	X	X	X	X

As requested in the questionnaire, the respondents were asked to if they could identify any additional key elements that were not listed. This process did not reveal any new element, which denotes either the message was not clearly communicated for the identified elements are quite comprehensive. Figure 15 shows the number of respondent to each element.

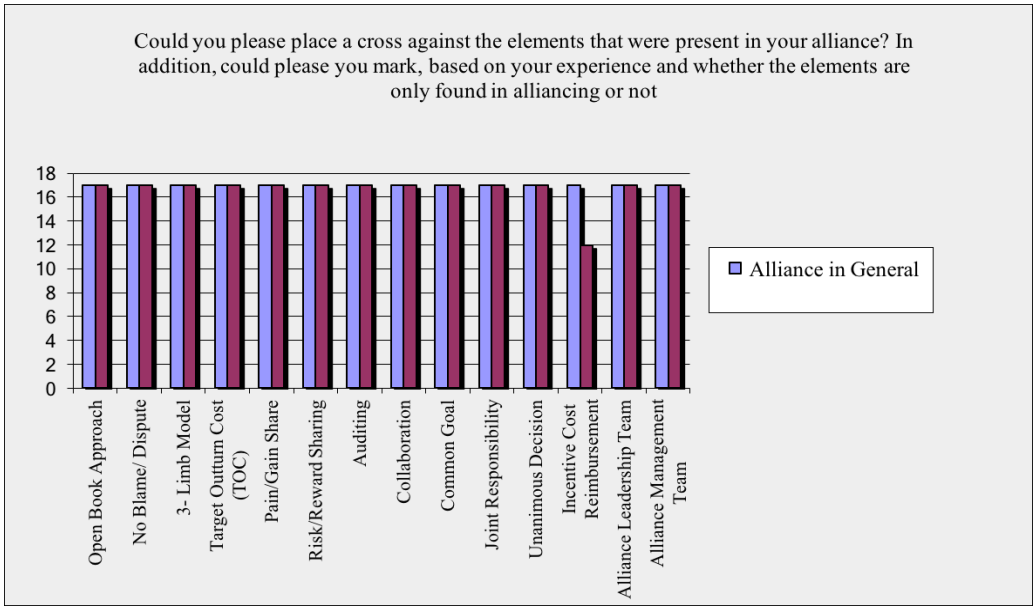

Figure 15. Alliance Elements Chart

5.3.3 Success Factors

To ensure the literature is relevant to the current experience in alliance, a list of success factors was also included in the questionnaire for the respondents. The Table 16 displays the results;

Table 16. Frequency table for success factors

	Strongly Disagree	Disagree	Neither Disagree nor Agree	Agree	Strongly Agree
Trust between Parties	0%	0%	0%	0%	100%
Equity	0%	0%	0%	0%	100%
Mutual goals and Objectives	0%	0%	0%	0%	100%

Table 16 (cont.)

Commercial Incentive	0%	0%	0%	0%	100%
Shared Knowledge	0%	0%	0%	0%	100%
Flexibility and Adaptability	0%	0%	0%	24%	76%
Open Communication	0%	0%	0%	0%	100%
Cooperative Spirit	0%	0%	0%	0%	100%
Integration of a Web-Based Management Program	0%	0%	0%	6%	94%
Facilitate on-going Workshops	0%	0%	0%	0%	100%
Sound Relationship	0%	0%	0%	0%	100%
Stretch Targets	0%	0%	0%	41%	59%
Alliance Structure	0%	0%	0%	0%	100%
Joint Evaluation Process	0%	0%	0%	6%	94%
Tight Alliance Outline	0%	0%	12%	35%	53%
Facilitation	0%	0%	0%	0%	88%
Best People for Project	0%	0%	0%	6%	94%
Strong Commitment by Client & Senior Management	0%	0%	0%	0%	100%

From the literature, especially from Jefferies et al, (2014) and Rowlinson and Cheng (2008) both identified some success factors that appears to be the alliance model standard practice. They are basically the fabric of the Australian alliance model.

And obtained results from the frequency table. They were certainly right, without the presence of the success factors the strategy would not be identified as an alliance and the success of the project is jeopardized. The results from Table 17 proves that to be true, where all mean values were high and a very low standard deviation.

Table 17. Median, mean and standard deviation table

	Median	**Mean**	**Standard Deviation**
Trust between Parties	5.00	5.00	0.00
Equity	5.00	5.00	0.00
Mutual goals and Objectives	5.00	5.00	0.00
Commercial Incentive	5.00	5.00	0.00
Shared Knowledge	5.00	5.00	0.00
Flexibility and Adaptability	5.00	4.76	0.42
Open Communication	5.00	5.00	0.00
Cooperative Spirit	5.00	5.00	0.00
Integration of a Web-Based Management Program	5.00	4.94	0.24
Facilitate on-going Workshops	5.00	5.00	0.00
Sound Relationship	5.00	5.00	0.00
Stretch Targets	5.00	4.59	0.49
Alliance Structure	5.00	5.00	0.00
Joint Evaluation Process	5.00	4.94	0.24
Tight Alliance Outline	5.00	4.41	0.69
Facilitation	5.00	5.00	0.32
Best People for Project	5.00	4.94	0.24
Strong Commitment by Client & Senior Management	5.00	5.00	0.00

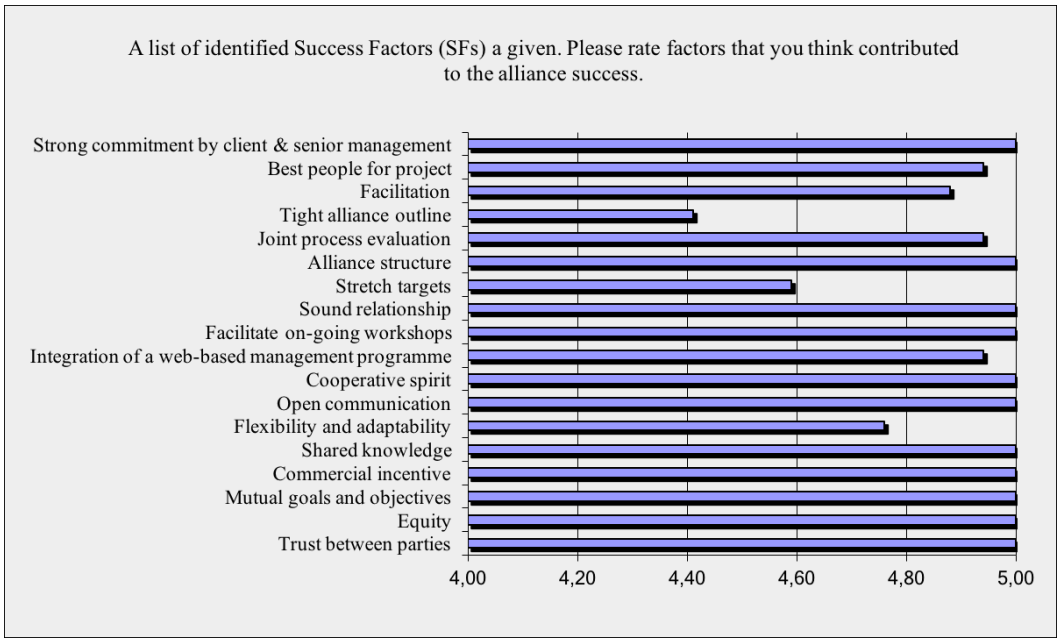

Figure 16. Average Score for Each Factor

Figure 16 shows the rating of each success factor using their mean score obtain from Table 17**.**

5.3.4 Barriers of Alliancing

The barriers of alliancing are the factors that could hinder its success or when they are encountered it is best not to use the alliance model. It was the last question in the questionnaire were the respondent rated each factor to his/her experience. The result is given below;

Table 18. Frequency table

	Strongly Disagree	**Disagree**	**Neither Disagree nor Agree**	**Agree**	**Strongly Agree**
No Clear Policy Toward Alliance	0%	0%	0%	6%	94%
Accountability Concerns	0%	0%	0%	6%	94%
Operational Problems	0%	0%	0%	6%	94%
No Standard Framework for Alliance	0%	0%	0%	6%	94%

Table 18 (cont.)

Friction between Alliance	0%	0%	0%	12%	88%
External Influences	0%	0%	18%	35%	47%
Not a priority	0%	0%	12%	47%	41%
Backlashes of the Experiment	6%	24%	59%	12%	0%
Complex Observability	0%	0%	35%	47%	18%
Lack of Project Team Motivation	0%	0%	6%	18%	76%
No Systematic development process	0%	0%	0%	29%	71%
Not Suiting Organization Culture	0%	0%	12%	6%	82%
Unforeseen Steps	0%	0%	6%	53%	41%
Lack of Investment in Knowledge	0%	0%	6%	12%	82%
Shortage of Personnel	0%	0%	0%	24%	76%
Lack of Enough Leadership	0%	0%	0%	24%	76%
Lack of Champions	0%	6%	35%	53%	6%

From the result shown in Table 18, almost all of the factors to be the barrier of alliance was agreed by the respondent that they are in fact barriers of the alliance model. Except a factor ‘Backlash of the Experiment’ which 60% neither agree nor disagree this shows their uncertainty in that factor. This leads to the analysis of the median, mean and standard deviation in Table 19 as presented below.

Table 19. Median, Mean and Standard Deviation Table

	Median	**Mean**	**Standard Deviation**
No Clear Policy Toward Alliance	5.00	4.94	0.24
Accountability Concerns	5.00	4.94	0.24
Operational Problems	5.00	4.94	0.24
No Standard Framework for Alliance	5.00	4.94	0.24
Friction between Alliance	5.00	4.88	0.32

Table 20 (cont.)

External Influences	4.00	4.29	0.75
Not a priority	4.00	4.29	0.67
Backlashes of the Experiment	3.00	2.76	0.73
Complex Observability	4.00	3.82	0.71
Lack of Project Team Motivation	5.00	4.71	0.57
No Systematic development process	5.00	4.71	0.46
Not Suiting Organization Culture	5.00	4.71	0.67
Unforeseen Steps	4.00	4.35	0.59
Lack of Investment in Knowledge	5.00	4.76	0.55
Shortage of Personnel	5.00	4.76	0.42
Lack of Enough Leadership	5.00	4.76	0.42
Lack of Champions	4.00	3.59	0.69

The result from the table above, shows the factor ‘Backlash of the experiment’ as a mean of has mean of lowest of 2.76 and high standard deviation of 0.73 showing variation in response. Also ‘External Influence’ has a high mean value of 4.29 and the highest standard deviation value of 0.75 displaying the inconsistence in this factor.

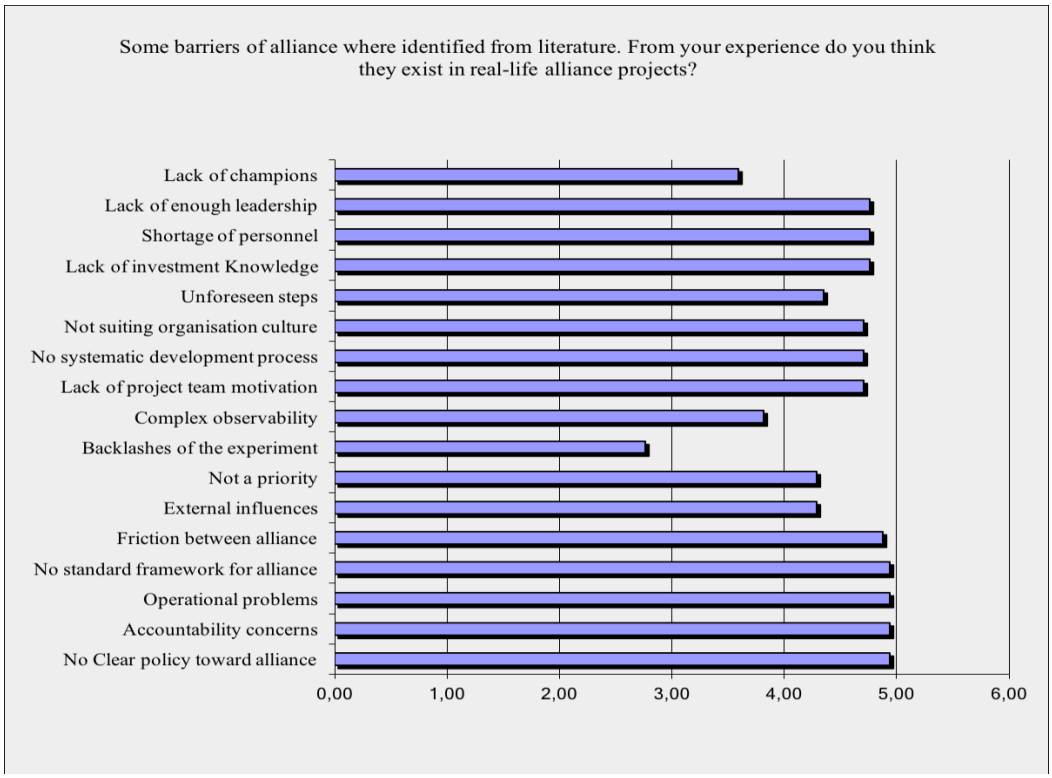

Figure 17. Average Score for Each Factor.

The average score for each barrier factor is drawn up in Figure 17 using their mean values.

5.4 Discussion

The discussion presents the perception of the studied literature and results from the questionnaire. The results from practitioners and their respective case studies represents their experiences and encounter are limited by their memories. Their responses were to the best of their knowledge and facts which were cross-checked against projects where possible. The finding will be related to findings from the literature study.

5.4.1 Project Complexities

The list of factors in the table was prepared based on different sources in the literature. The mean values obtained for each factor for each type of complexity and average score was put together. The Remington & Pollack Model (2007) and Terry Williams Model (2002) bears resemblance with the results obtained (Jacob, 2009).

However, the authors of each model categorized their project complexities into structural, technical, directional and temporal complexity, where each factor are found as interdependencies in one of these categorizes.

The resulting factors from the project complexity were then transferred to as project qualities for the project alliance part of the study. This was done because of the complexity factors were as well stated as project qualities in some literature. However, factors such as overlap phases or concurrency, high degree of technology, high level of interdependencies, unsuitable contract type, cultural differences and communication between different part of organization where not included as part of the project qualities because some were not stated in any literature as part of project qualities and while others were either part of the success factors or barriers to the alliance model.

5.4.2 Project Qualities

Mostly, qualities of a project are firstly taken into account with numerous other factors while determining the PDM. And the alliancing model is not suitable for every infrastructure project. Nonetheless, some project has some key qualities that make them highly suitable for the alliance model.

High Complexity in project are been recommended as suitable for alliance project by Chen et. al., (2010) and (DTF, 2010). High Risk/Uncertainty in project are best dealt with using alliancing where risk is shared among the parties and each party and each party is incentivized to manage risk and work together (Walker et al., 2015, Chen et. al., 2012, Russo & Cesarani, 2017). Very Tight Time Frame, rather than organizational capacity but induced by project risk is typically suited for alliance (IUK, 2014, Commonwealth of Australian, 2015). Complex Stakeholder issues is

recommended as a project quality for alliance by the government guideline (Walker & Lloyd-walker, 2016, Young et al., 2016). Scope Change/Unclear Scope, many alliance projects were the result of poorly define scope or had an unclear scope (Walker et. al., 2013, Love et. al.,2010). Complex Environment is a quality that can be addressed by alliancing (Lahdenpera, 2012). Budget Constraint, project with high requirement in cost control often turn to the alliance model as the PDM (Young et al., 2016). Need for Owner is also another quality suggested by the guidelines to alliance project (Commonwealth of Australian, 2015, Young, 2016). High Cost/Large Project; project with duration of 12 months and above or value over A$10M are recommended by the government to use the alliancing approach (Jefferies et. al., 2014). New Innovation; infrastructure projects with the need for new or high innovation facilitate the use of alliance as the top choice (Spang & Riemann, 2014, Chen et al., 2010). Long Term; Yeung et al, (2015) and Laan et al, (2011) perceived this quality as an essential element of alliance. Need for Flexibility; Chen et al., (2014) and Walker et al, (2012) gave flexibility as other motive for using alliancing. Environmental Challenges; project that exhibits significant environmental challenges, alliancing is the key (Jefferies et al, 2014, Cocks et al., 2011). Shortage of Resources; scarce in resources upon critical reason is often relied for choosing the alliance contracting (Sommerville, 2010).

5.4.3 Alliance Element

In all the literature and documents on alliancing, it includes a small definition of alliancing. These definitions were collected and analyzed in other to determine the key elements of alliancing.

Open-book Approach, No Blame/ Dispute, Pain/Gain Share, Unanimous Decision, Incentive Cost Reimbursement, are been identified in the literature by Lahdenpera,

(2012). The alliance contract is structured around the 3-Limb approach (Walker et al., 2015 and Commonwealth of Australian, 2015). The Target Outturn Cost (TOC) is the core element of the compensation model (ADIT, 2011). Risk/Reward Sharing should be built when establishing an alliance (IUK, 2014). Auditing; the practice is reinforced by third party auditing (Department of Treasury & Finance, 2015). Collaboration is needed to achieve outstanding results (Walker & Lloyd-Walker, 2016). Common Goal; the alliance philosophy focuses on all participants achieving common goal (Gransberg et al., 2015). Joint Responsibility; it is best implanted by using a multi-party collaborative agreement (Department of Treasury & Finance, 2015). The ALT and AMT are one of the three organizational structure of alliance (Weatheral, 2013).

5.4.4 Success Factors and Barriers

The answers from the respondent prove that the success factors and barriers to alliance found in literature are relevant to current experience.

The 18 success factors identified by Jefferies et al, (2012) really seems to be the standard practice for the alliance model where all respondents agreed with each factor and also it show that these factors are now engrained into the model. Also, some key factors such as Trust, Mutual goal and objectives, Shared knowledge, Open communication etc. found by (Russo & Cesarani, 2017) also aligned with finding in this study.

Barriers of alliancing identified from the literature also proves to be factors that constrain the alliance model, making them unsuitable when these factors are found. In this list of the barrier factors, factors like ‘backslash of experiment and ‘external

influence' which most respondent responded as neither agree nor disagree are excluded from the list because of the uncertainty in them.

5.5 Comparison between Australian and Finland Alliance

Australia is a country that has taken alliancing from its infant stage and developed it into a world class project delivery method as it's known today. It has become the world's most experiences country when it comes to alliance to deliver infrastructure projects (Walker et al, 2015).

The Finland government, who adopted the model from the Australians in 2007 and now has approximately 40 projects with Kokemaki alliance (Railway renovation) been the first alliance project.

For the first comparison on project qualities which would be on agree and strongly agree. Taking 2 qualities "High risk/uncertainty" and "need or owner involvement" with both frequency of 12% and 82% and 6% and 88% respectively. For both qualities, all Australian respondents strongly agreed with them but as or the Finnish respondents some agreed while some strongly agreed. This is because the experience gap between the two countries. The same goes for the success factors and barriers.

For the alliance elements, all the Australian respondents confirmed all the factors as being the elements of alliancing as well as the Finnish respondents except for a single element "incentive cost reimbursement'. None of the 5 respondents checked the element. And the reason was not stated. But according to a conference paper published by the Finnish Transport Agency they mentioned that the adopted alliance model from Australia has some difficulties with the EU-legislation (Agency,2012), which might be the reason but not certainly.

5.6 Model Framework for Alliancing in Complex Infrastructure Projects.

The model framework for alliancing in complex infrastructure projects is adopted and modified from Love et el, (2010). The factors that are considered to be elements of alliancing are distributed and categorized into different phases. It is recommended that the success factors are required throughout all phases of the alliance life cycle. However, their respective weighting will differ for instance, all the cooperation and collaboration factors will have high ranks in all stages, however amid the development stage they become less important as goals and target outturn cost (TOC) are being identified. Figure 18 presents a framework model for alliancing.

To ensure the probability of project success the SFs identified are distributed under the following headings which are Collaboration and Cooperation, Management and Support, Knowledge and learning this is to promote and establish consistency.

- Management and support factors include commercial incentive, integrated web-based management, facilitation, alliance structure, stretch targets, alliance outline and strong commitments by client and senior management.
- Collaboration and cooperation factors include Mutual trust, Mutual goal and objectives, open communication, cooperative spirit and sound relationship.
- Knowledge and learning factors include shared knowledge, flexibility and adaptability, workshop and joint evaluation.

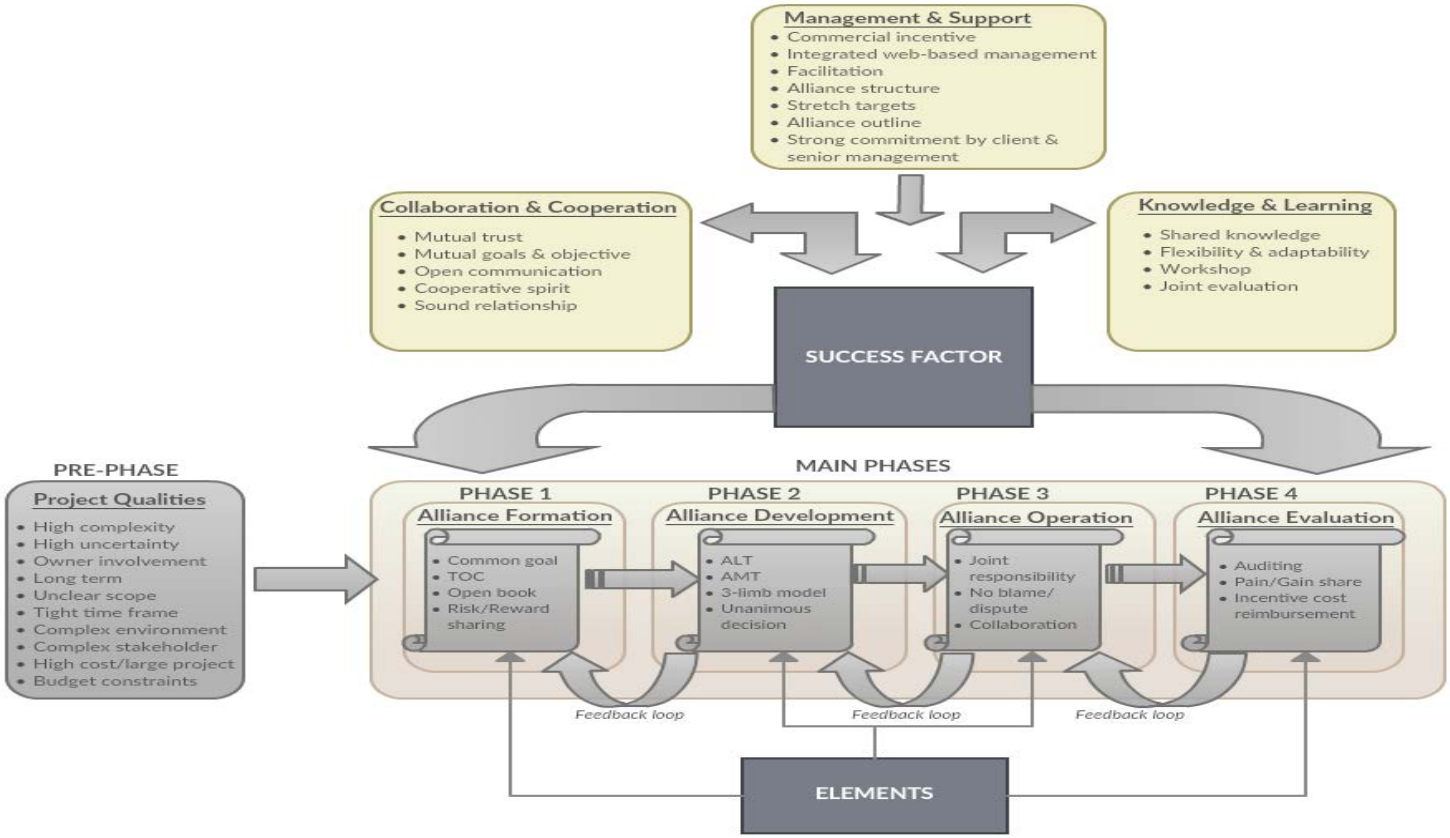

Figure 18. Conceptual Framework for Alliancing (Love et al, 2010)

5.5.1 Project Qualities

The pre-phase or in other words phase 0 is the first and foremost step before the alliance is even considered, since not all project can be suitable for the alliancing delivery method. Most often, the qualities are taken into account with many other factors before selecting the delivery method. However, in some cases, the decision to use the alliancing model on a project is purely based one or more qualities listed on Figure 18 above.

5.5.2 Alliance Formation

The first phase is a formal process involving agreement and negotiations between the partners. Firm manifest an interest joining an alliance by analyzing reasons and potential benefits. Joint expectation is established where common goal, TOC, open book, risk/reward sharing are determined. But the relationship is fragile as trust has not yet been developed. The agreement must be in ’plain language’ and connects strategies with objectives goal of all partners.

High misinformation can also be experienced at this stage because trust and performance target are not yet established. Open communication and having a cooperative spirit can help build the social bond between the teams.

Also, support from the senior management team should be provided to the alliance team throughout all stages as it will promote confidence to the alliance teams.

5.5.3 Alliance Development

This is the second phase where teams are created such as the alliance leadership team and alliance management team (AMT). And also, the 3-limb model i.e. the reimbursement cost, fee to cover corporate overhead plus margin profit and then pain or gain sharing. In establishing these elements unanimous decisions are made.

5.5.4 Alliance Operation

This is the third phase of the process where the partnership evolves. Mutually goals and targets that were formed during phase 1 are formalized, then trust is being built and also vision is translated in economic reality. Parties collaboratively work together on a daily basis. They share joint responsibilities with no blame/dispute and have to make important decisions related to coordination and monitoring the alliance activities and learning process.

Open communication is required to acquire a smooth implementation on all level of management work to facilitate the transfer and sharing of information.

5.5.5 Alliance Evaluation

In this phase, agreement and commitments are put into action. After the construction has been completed, each partner is evaluated and identifies its area for improvement for future direction. The evaluation can result to either partners deciding to terminate it or undertake additional project under the alliance. Auditing will be conducted on detailed financial record of each participant. Pain/gain equitable sharing between alliance participants depending on the actual outturn cost (AOC) compared with the pre-agreed target. Each participant is reimbursed its actual cost incurred on the project. Result of the evaluation is refined and modified through the feedback loop, where the operations phase is revisited and improved

The evaluation usually brings about the partners choosing to engage on additional projects under the alliance or end it. However, renewal can only be achieved if the success factors such as open communication, effective coordination and trust are present.

5.7 Managerial Implications

The framework in Figure 18 above on alliancing has some important managerial implications about the actions and decisions to make during the alliance life cycle. When a participant chooses to enter a project alliance, several aspects should be taken into account.

During the formation phase (first stage), the party should look and maintain high degree of compatibility with their own partners for the entire alliance life cycle together with the choice of the most suitable alliance governance form. Alliances often fail because of inexperienced partners, instead of conducting a detailed diligence in partner selection, they pay more attention on their own objectives.

At the development phase (second stage) when establishing the ALT and AMT members, personnel should be from each participants organization including the owner's organization unless one side lack experience personnel or is new to the business. Emphasis was put on this area because during the next phase which is the operational phase, the teams, worker and superiors will heavily be dependent on the ALT and AMT for transparency and effective coordination to ensure the alliance success.

Amid operational phase (third stage), partners should focus more on the development of relational factors such as communication, coordination, mutual trust, commitment, knowledge sharing, joint responsibility and joint problem solving. These factors represent the alliance social capital, which leads to higher level of information sharing, cooperation, productivity, effective coordination, reduces relational risks

and improves open communication among partners with increase in overall success probability.

Finally, during the (last stage) evaluation phase, the evaluation of alliance performance is required through many perspectives: economic, learning, relational and operational.

Chapter 6

CONCLUSION AND RECOMMENDATION

6.1 Conclusion

This thesis adds more insight to the current knowledge on alliancing by answering these questions;

1. What are the factors that determine a project complexity?
2. What qualities make an infrastructure project suitable for alliancing?
3. What are the key elements in alliancing?
4. What are the success factors and barriers when choosing alliancing for infrastructure projects?

Because of the relatively new leap into the development in delivery of complex infrastructure projects around the world, the alliancing model among the more establish projects delivery methods is still discovering its place. Complexity in projects is neither merely categorizing particular projects as either complex or not. Importance should be given in finding out the different source of complexity and in what manner it might affect the project. Since the birth of alliance in the 80's, the development has been rapidly increased. This rapid development has prompt to much disarray surrounding alliancing, specifically what separates it from other collaborative contracts and other relational contracts. The confusion is yet to be fully addressed with the body of knowledge. Due to various gaps identified in this area of study, the study provides results that help fill those gaps.

In light of the literature, document study and case projects conducted as part of this research, this study explores the factors that determine complexity in infrastructure projects.

Project complexities factors concluded in this study are as follows; High Complexity, High Risk/Uncertainties, Tight Time Frame, Complex Stakeholders, Scope Change/ Unclear Scope, Complex Environment, Budget Constraints, Need for Owner Involvement, High Cost/ Large Project, New Innovation, Long Term, Need for Flexibility, Environmental Challenges, Shortage of Resources.

In addition to this study, verifying what makes an alliance an alliance, by identifying fourteen qualities of an infrastructure project that makes it suitable for alliancing. Established from literature and results from the survey questionnaire. It can be concluded that these particular qualities make the alliance a very effective PDM for infrastructure projects, provided it is chosen for the right reasons.

The following factors are qualified as the Project qualities suitable for an infrastructure alliance project. High Complexity, Need for Owner Involvement, High Risk/ Uncertainties, High Cost/ Large Project, Tight Time Frame, New Innovation, Complex Stakeholders, Long Term, Scope Change/ Unclear Scope, Need for Flexibility, Complex Environment, Environmental Challenges, Budget Constraints, Shortage of Resources

Likewise, in discovering more on what makes an alliance an alliance, elements that make up the alliance model are identified. In the analysis process, some identified elements were related to each other, but their importance secures them their

independent own place. All the elements are being confirmed by the case projects in both Australia and Finland.

The element of the alliance model are as follows; Open Book Approach, Collaboration, No Blame/Dispute, Common Goal, 3-Limb Model, Joint Responsibility, Target Outturn Cost (TOC), Unanimous Decision, Pain/Gain Share, Incentive Cost Reimbursement, Risk/Reward Sharing, Alliance Leadership Team, Auditing, Alliance Management Team

Additional success factor and barriers to alliancing where looked into. When the success factors in the literature and case projects were compared, all the factors checked out. The bar has been raised in other to input these factors into the model. Nevertheless, the success factors are very important as it help to shows alliance to the industry and why each factor has its place in the model. This also determine a starting point on how the model could be improved.

Trust between Parties, Facilitate on-going Workshops, Equity, Sound Relationship, Mutual goals and Objectives, Stretch Targets, Commercial Incentive, Alliance Structure, Shared Knowledge, Joint Evaluation Process, Flexibility and Adaptability, Tight Alliance Outline, Open Communication, Facilitation, Cooperative Spirit, Best People for Project, Integration of a Web-Based Management Program, Strong Commitment by Client & Senior Management

For the barriers to alliancing, limited work was performed. The preliminary research done on the barrier of alliance identified the key factors that may inhibit the choice of alliance as the preferred PDM.

The concluded barriers are; No Clear Policy Toward Alliance, Lack of Project Team Motivation, Accountability Concerns, No Systematic development process, Operational Problems, Not Suiting Organization Culture, No Standard Framework for Alliance, Unforeseen Steps, Friction between Alliance, Lack of Investment in Knowledge, Not a priority, Shortage of Personnel, Complex Observability, Lack of Enough Leadership

In view of the results of the study a conclusion of what makes an alliance an alliance, the qualities a project need to make it suitable for alliancing, the element essential for the alliance model, the success factors and barriers are reached. However, the conclusion is largely constructed on the Australian experience. Nonetheless, their lesson learned can be transferred to other countries

6.2 Recommendations

The following recommendations are suggested for research based on the findings in this study;

- For new users establishing and/or implementing an alliance, they should be fully informed the risks and benefits. Also, the selection process should reveal the prospective partners who they really are and show that you understand the principles.
- Having a combined understanding of knowing when to selecting alliancing and its success factors and barriers, industry, government, practitioners should make better informed decision on adopting the alliance model into their respective countries and industries.
- Given that the study provides the basis of the alliancing model, academics and practitioners who are new to the alliance technique should understand

what alliancing is, what to consider, when to use it and how to make it effective and successful.

- Project managers and leaders in an alliance project should ensure a cooperative alliance team, sustain relationships and communicate with project team and management top level.
- For the development of a peak performing team, use an alliance framework that provides the right foundation.
- When using the alliancing model invest in people and leadership, the focus should be on value no cost, because effective leaders creates and sustain the environment that produces high result and performance.

6.3 Recommendations for Future Study

The starting point for future study is to build upon and enhance this study by addressing the identified limitation of this study. The study could be enhanced by conducting interview with first hand experienced practitioners in alliancing. Also collecting more results from numerous academic, industrial and governmental publications to confirm, widen and challenge the findings present in this study. Moreover, this study focused more on alliancing tangible “hand” elements. To expand upon these outcome, additional work including the “soft” element of alliancing could be undertaken.

Further works could be performed on elements unique to alliancing and compared against all other infrastructure project delivery method. Likewise, work should be done to identify success factors and barriers specifically for immature industry or country implementing the alliancing model freshly.

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APPENDICES

Appendix A: Project Complexities Questionnaire

Complexities in Infrastructure Projects Questionnaire

As part of my MBA research thesis at the Eastern Mediterranean University, I am conducting a survey that investigates, the identified project complexities that influenced the selection of project delivery method (PDM) for infrastructure projects. I will appreciate if you could complete the following table.

Respondent's Details

Name: _____ Field of Study: _____

Email: _____

Project Type:

☐ Airport ☐ Sewers

☐ Highway ☐ Dam and Reservoirs

☐ Bridge ☐ Water Supply

☐ Rail ☐ Power grids

☐ Tunnel ☐ Telecommunication

☐ Others, please specify: _____

For each of these complexities, circle the response that best characterize your project circumstance.

	Influenced the PDM selection				
Complexities	**Strongly Disagree**	**Disagree**	**Neither Agree nor Disagree**	**Agree**	**Strongly Agree**
High Complexity	1	2	3	4	5
High Risk/ Uncertainties	1	2	3	4	5
Tight Time Frame	1	2	3	4	5
Complex Stakeholders	1	2	3	4	5
Scope Change/ Unclear Scope	1	2	3	4	5
Complex Environment	1	2	3	4	5
Budget Constraints	1	2	3	4	5
Need for Owner Involvement	1	2	3	4	5
High Cost/ Large Project	1	2	3	4	5
New Innovation	1	2	3	4	5
Long Term	1	2	3	4	5
Other:	1	2	3	4	5
Other:	1	2	3	4	5
Other:	1	2	3	4	5

Where all the complexities addressed by the selected PDM in your project?

☐ Yes ☐ No

Have your heard of a project delivery method (PDM) called Alliance or Project Alliance?

☐ Yes ☐ No

THANK YOU FOR YOUR TIME

Appendix B: Alliancing in Complex Infrastructure Projects Questionnaire

Name of Project:

Your role in the project:

Size of the project ($):

Number of Alliances Parties:

Duration:

The table on the next page contains the identified project qualities/ characteristics that influenced the selection of alliancing as the PDM. For each of these qualities, circle the response that best characterize your project circumstance, where;

1= Strongly Disagree

2= Disagree

3 = Neither Agree nor Disagree

4= Agree

5= Strongly Agree

For the next table which contains identified elements, could you please place a cross against the elements that were present in your alliance? In addition, could please you mark, based on your experience and whether the elements are only found in alliancing or not. Some space is left at the bottom if there are additional elements that can be added to the list

Q1. Identified project qualities that influenced the selection of alliancing as the PDM.

	Influenced the PDM selection				
Project Qualities	**Strongly Disagree**	**Disagree**	**Neither Agree nor Disagree**	**Agree**	**Strongly Agree**
High Complexity	1	2	3	4	5
High Risk/ Uncertainties	1	2	3	4	5
Tight Time Frame	1	2	3	4	5
Complex Stakeholders	1	2	3	4	5
Scope Change/ Unclear Scope	1	2	3	4	5
Complex Environment	1	2	3	4	5
Budget Constraints	1	2	3	4	5
Need for Owner Involvement	1	2	3	4	5
High Cost/ Large Project	1	2	3	4	5
New Innovation	1	2	3	4	5
Long Term	1	2	3	4	5
Need for Flexibility	1	2	3	4	5
Environmental Challenges	1	2	3	4	5
Shortage of Resources	1	2	3	4	5
Other:	1	2	3	4	5
Other:	1	2	3	4	5

Q2. Could you please place a cross against the elements that were present in your alliance? In addition, could please you mark, based on your experience and whether the elements are only found in alliancing or not.

Elements of Alliance	**Part of Project**	**Only Alliance**
Open Book Approach		
No Blame/ Dispute		
3- Limb Model		
Target Outturn Cost (TOC)		
Pain/Gain Share		
Risk/Reward Sharing		
Auditing		
Collaboration		
Common Goal		
Joint Responsibility		
Unanimous Decision		
Incentive Cost Reimbursement		
Alliance Leadership Team		
Alliance Management Team		

Can you please identify any other additional elements that can be added to the list?

-
-
-

Q3. A list of identified Success Factors (SFs) a given. Please rate factors that you think contributed to the alliance success.

	Strongly Disagree	Disagree	Neither Disagree nor Agree	Agree	Strongly Agree
Trust between Parties	1	2	3	4	5
Equity	1	2	3	4	5
Mutual goals and Objectives	1	2	3	4	5
Commercial Incentive	1	2	3	4	5
Shared Knowledge	1	2	3	4	5
Flexibility and Adaptability	1	2	3	4	5
Open Communication	1	2	3	4	5
Cooperative Spirit	1	2	3	4	5
Integration of a Web-Based Management Program	1	2	3	4	5
Facilitate on-going Workshops	1	2	3	4	5
Sound Relationship	1	2	3	4	5
Stretch Targets	1	2	3	4	5
Alliance Structure	1	2	3	4	5
Joint Evaluation Process	1	2	3	4	5
Tight Alliance Outline	1	2	3	4	5
Facilitation	1	2	3	4	5
Best People for Project	1	2	3	4	5
Strong Commitment by Client & Senior Management	1	2	3	4	5
Others:	1	2	3	4	5

Q4. Some barriers of alliance where identified from literature. From your experience do you think they exist in real-life alliance projects?

	Strongly Disagree	Disagree	Neither Disagree nor Agree	Agree	Strongly Agree
No Clear Policy Toward Alliance	1	2	3	4	5
Accountability Concerns	1	2	3	4	5
Operational Problems	1	2	3	4	5
No Standard Framework for Alliance	1	2	3	4	5
Friction between Alliance	1	2	3	4	5
External Influences	1	2	3	4	5
Not a priority	1	2	3	4	5
Backlashes of the Experiment	1	2	3	4	5
Complex Observability	1	2	3	4	5
Lack of Project Team Motivation	1	2	3	4	5
No Systematic development process	1	2	3	4	5

Not Suiting Organization Culture	1	2	3	4	5
Unforeseen Steps	1	2	3	4	5
Lack of Investment in Knowledge	1	2	3	4	5
Shortage of Personnel	1	2	3	4	5
Lack of Enough Leadership	1	2	3	4	5
Lack of Champions	1	2	3	4	5
No Clear Policy Toward Alliance	1	2	3	4	5
Accountability Concerns	1	2	3	4	5
Others:	1	2	3	4	5

Thank you for your time.

Appendix C: Charts