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Benchmarking Relationship-Based Contracting and Performance Measurement of the Construction Industry into the Upstream Oil and Gas Industry

For Complex Procurements and Improvement

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Abstract

The upstream oil and gas industry suffers from inefficient performances in projects. On one hand, motivated by the facts that construction projects have achieved positive results by carrying out ongoing research on relationship-based contracting (partnering and alliancing) and implementing its performance measurement, this thesis aims to investigate the key elements (KEs) and key performance indicators (KPIs) of partnering and alliancing (P&A) that can be applied from construction projects to upstream O&G construction projects for benchmarking in order to handle complex procurements and improve efficiency of performances. The analysis of empirical data identifies that the KEs of P&A are (1) trust (2) effective communication (3) clear role and responsibility (4) cooperation and collaboration (5) mutual objectives and goals (6) risk and reward sharing mechanism (7) conflict and problem resolution and (8) continuous evaluation and improvement, and the KPIs of P&A are (1) health and safety (2) quality (3) trust and respect (4) effective communication (5) client's satisfaction (6) cost (7) time (8) schedule and (9) harmonious and cooperative working relationships. The similarities between the literature review and the findings indicate "trust", "effective communication", "risk and reward sharing mechanism", "cooperation and collaboration" and "continuous evaluation and improvement" as defining features of KEs of P&A projects irrespective of industries. The notable differences illustrate that although both projects share common characteristics, certain elements of P&A can be difference in practices. The similarities in relation with the KPIs of P&A are found as "health and safety", "quality" and additionally "effective communication". On one hand, it is an interesting fact that "client's satisfaction" is identified in upstream O&G construction projects from the findings. Another remarkable difference is that "harmonious and cooperative working relationships" is appeared as the KPI of P&A, and moreover, "trust and respect" is ranked higher in upstream O&G construction projects compared to construction projects. The interview emphasizes the importance of carrying out a feasibility study and increasing understanding of P&A prior to its application. In addition, due to excessive competitiveness in most consortium projects, the win-win philosophy becomes "buying-in". Also the leadership skills of a project director and manager and an establishment of a cooperative and collaborative culture are mentioned. Moreover, the power trip, egoism and opportunism behaviors are pointed out as the chronical problems in projects.

Preface

The oil and gas (O&G) industry is one of the vastest and most overwhelming industry, so it is inevitable to have difficulties in terms of managing and handling O&G projects. In order to enrich the upstream O&G industry, it is essential to keep up and aim for continuous development in diverse aspects (e.g. high technology, risk and change management, etc.). In addition to that, unlike other industries, the process of upstream oil and gas construction projects require a need for skillful manpower control and cannot be easily automated, therefore, I think it should be more "people-oriented" the way of managing projects than any other industries.

As I found this topic of research a very attractive and challenging subject, I hope the thesis may contribute to the sustainable development of the upstream O&G industry by taking advantage of relationship-based contracting approach and its performance measurement.

This thesis attempts to provide guidelines for benchmarking relationship-based contracting (partnering and alliancing) and its performance measurement so as to handle complex procurements and achieve continuous improvement in upstream O&G construction projects.

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Abbreviations

AB	Alliance Board
CI	Continuous Improvement
CSF	Critical Success Factor
O&G	Oil and Gas
KEs	Key elements
KPIs	Key Performance Indicators
P&A	Partnering and Alliancing
PI(s)	Performance Indicator(s)
PM	Performance Measurement
PMS	Performance Measurement System
AMT/PMT	Alliance/Project Management Team
RBC	Relationship-Based Contracting

1 Introduction

The upstream oil and gas (O&G) industry encounters strongly unsatisfactory performances in terms of efficiency; typically measured in given budget and time and in terms of meeting the specification and quality in projects. The remarkable reason is that the rapidly changing environment (e.g. market conditions) and a need for high technology in upstream O&G projects over the years have accelerated the vulnerable characteristics of the upstream process in the O&G industry (Halman & Braks, 1999; Merrow, 2012; Olsen et al., 2005; Sakal, 2005). In addition, needs and expectations of stakeholders are more sophisticated than before (Merrow, 2012; Naoum, 2003). Moreover, traditional contracting methods cause adversarial relationships between project participants that bring blame games and litigation issues. This results in nothing but bad profits and poor outcomes in upstream O&G projects (Halman & Braks, 1999; Olsen et al., 2005; Sakal, 2005).

For this reason, the upstream O&G industry has applied several approaches (e.g. incentive contracting, partnering, alliancing, etc.) to mitigate bad profits and poor outcomes in projects. Yet despite these efforts, there are still shortcomings to run upstream O&G projects. Motivated by the facts that construction projects have achieved positive results by undertaking ongoing research on relationship-based contracting and implementing its performance measurement (PM) to increase efficiency of performances, questions are raised. What are "relationship-based contracting" and "performance measurement"? And since construction projects and upstream O&G construction projects share common characteristics, how can these experiences (i.e. best practices) be transferred and applied from construction projects to upstream O&G construction projects in order to increase efficiency of performances so that profits all parties involved can be ensured.

Relationship-based contracting (partnering and alliancing), which is opposed to the traditional contracting methods, is based on the recognition of mutual benefits, a win-win scenario and better risk sharing mechanism through more cooperative relationships with all parties involved in projects. The desired results are cost reduction, shortened duration and an improvement in the quality work of projects (Davis & Love, 2011; Jefferies et al., 2014; Jones, 2012; Yeung et al., 2009b). Many studies and researches have proven that projects under P&A brought positive results compared to the traditional contracting methods (CII, 1996; Farrell et al., 1996; Halman & Braks, 1999; Olsen et al., 2005; Sakal, 2005; Walker et al., 2002). However, P&A itself does not solve all the problems, in other words, not all P&A

projects achieve success. There are still limitations and pitfalls of implementing and undertaking P&A projects Aarseth et al., 2012; Adnan et al., 2012; Chan et al., 2003; Eriksson, 2010; Farrell et al., 1996; Herten & Peeters, 1986; Ingirige &Sexton, 2006; Suprapto et al, 2015; Winch, 2012, because it is only a management tool, and as the term "relationship-based contracting" indicates, the success of P&A projects depends on project participants who drive it (Chan et al., 2003). Moreover, P&A projects contain behavioral aspects, it is imperative to develop and measure relationships in order to evaluate success as well as diagnose health (i.e. health check) of the relationships in addition to result and process indicators (Crane et al., 1999; Chan et al., 2003; Yeung et al., 2009b). So that senior executives and project managers not only to assess success, but also use these performance indicators for benchmarking to manage and monitor their individual projects (Yeung et al., 2009a).

The aim of this thesis is to investigate KEs and KPIs of P&A that can be applied from construction projects to upstream O&G construction projects for benchmarking so as to handle complex procurements and improve efficiency of performances. In the light of the statements above, this paper defines research questions to be explored as follows:

Q1. What are the key elements and key performance indicators of partnering and alliancing in upstream O&G construction projects?

Q2. What are the similarities and differences between the literature review and the findings?

In respond to discuss the defined research questions, this thesis is structured as follows: firstly, this thesis looks into the definitions and importance of benchmarking, CI, PM, PIs as well as their brief practices in construction and upstream O&G projects. Secondly, different views of project management and project success are elaborated; how such views are different from past to present. Third, characteristics of construction and upstream O&G construction projects are illustrated to clarify the application and research purposes. Fourth, this thesis looks into the history and definition of relationship-based contracting (partnering and alliancing) to understand important concepts, principles, etc. Fifth, the limitations and pitfalls of P&A are illustrated to support the importance of ongoing research. Additionally, the KEs and KPIs of P&A are identified from the literature review. In the chapter four, the result analysis of empirical data from a questionnaire survey and interviews are illustrated. In the chapter five, the discussion is elaborated; the identified KEs and KPIs of upstream O&G

construction projects as well as the similarities and differences between the literature review and the findings. Lastly, the conclusion of this thesis is presented and the limitations of the research as well.

2 Research Methodology

In this chapter, the research methodology of this thesis is illustrated. The research strategy for the thesis is based on a grounded theory from the literature review and supplemented by the questionnaire survey to collect the empirical data. The choice of research methods is the mixed; qualitative method and quantitative methods in order to collect and analyze the survey data for the discussion on the defined research questions (Saunders et al., 2009).

First, the questionnaire survey form is developed from the comprehensive literature review, and then the survey is conducted to collect the empirical data. After conducting the survey, statistical data analysis is carried out by using SPSS, which is a comprehensive software package for statistical analysis and data management. The mean value method and Kendall's coefficient of concordance (W) are used to determine and observe the different importance and ranking of the KEs and KPIs of P&A. Lastly, the anonymous interview is performed to gain practical information and insights of upstream O&G construction projects.

2.1 Data Collection

The comprehensive review of literatures is done (including journal articles, books, research reports) to get to know important principles, success factors, elements, concepts, characteristics as well as performance indicators of P&A as a point of departure. Additionally, it is to see how different elements (e.g. concepts, principles, factors, components, elements, etc.) and PIs are mentioned in descriptions of P&A to develop the questionnaire survey form for conducting the survey. The selection of literatures is based on websites mainly Oria and Google scholar with key words: partnering, alliancing, relationship-based/relational contracting benchmarking, performance measures/indicators, continuous improvement in mainly the construction industry, the upstream O&G industry and project management fields. This thesis covers both partnering and alliancing practices, which are from construction projects and upstream O&G construction projects, but the identified elements and PIs for the literature review and the survey form are from construction projects in a global context (Australia, Europe, Hong Kong, the UK, USA).

Next, identified elements and PIs of P&A are organized in line with by the authors and total numbers counted to estimate and determine the importance of each element and PI. Lastly, the

questionnaire survey form (see appendix C) is developed based on the literature review (see appendix A and B), and distributed to Korean shipyard companies (including small and medium-sized enterprises and small, technology-based, oil-related companies) in a Google survey form and MS office word format (English and Korean version). The reason why the survey is conducted in Korea, according to the Clarkson Research (2016), Korean shipyards have the highest number of compensated gross tonnage (CGT) and also backlog during the past years; a number of big onshore O&G construction projects (from engineering to commissioning) have been carried out in the Korean shipyards e.g. FPSO and other offshore platform projects.

Respondents are asked to answer back the following question: which elements and PIs are the most important ones at what extent based on their work experiences in upstream O&G construction projects whether they have P&A experiences (see appendices D). A five-point Likert scales is used from 1 to 5, where 1=less important, 2=slightly important, 3=important, 4=very important to 5=most important as to identify the importance and ranking of each element and PI. In order to increase reliability and validity of the research result, high respondents are required.

In addition to the survey, the anonymous interview is carried out to gain understanding of upstream O&G construction practices and provide information that enhances the result for the discussion. The interview is designed a non-standardized interview, which is an interview method, does not constrain interviewees to boost interactions between interviewer and interviewee (e.g. without an interview chart and type/order of questions). The advantage of this interview method is that it is easy to create rapport between interviewer and interviewee. Therefore, natural interactions enable to collect data, which have validity and more possibilities of finding new facts and/or ideas. On the other hand, the disadvantage of this interview is that it can be difficult to coding the interview results, and thus reliability may not be high. The data is collected under anonymity and it is promised that the collected data will be used only for academic purposes. Interviewees are encouraged to illustrate opinions on P&A approach and PM regardless of working experience in P&A projects, it is to investigate chronical problems and any improvement should be made based on interviewees' experiences in the field of the upstream O&G construction projects.

2.2 Data Analysis

Statistical package for social sciences (SPSS) is utilized for statistical analysis of the collected data. The mean value method and Kendall's coefficient of concordance (W) are used to determine and observe the different importance and ranking of the KEs and KPIs of P&A. Kendall's coefficient of concordance (W) is a technique that can be used to measure an agreement of different parties (respondents) on the ranking. A value of W will be close zero (0), if there is a lack consensus within a particular group on the rank of the KEs and/or KPIs under the survey data. On the other hand, if there is an agreement, a value of W will be close to one (1) (Chan et al., 2003). For example, a research hypothesis is that an order assessment will be similar about N assessors of K objects. A testing hypothesis of null hypothesis (H_0) in relation with coefficient of concordance can be that there is no regularity of an order assessment way of assessors. Alternative hypothesis (H_1) can be that there is a regularity of an order assessment way of assessors. If P-value (P) is lower than the level of significance 0.05 (5%), the null hypothesis will be (H_0) rejected and the alternative hypothesis (H_1) will be accepted i.e. it can be considered as a good result if P-value is as low as possible. In addition, reliability analysis is performed to evaluate an internal consistency of the measured KEs and KPIs. Cronbach's Alpha coefficient indicates the internal consistency of measured items and assesses reliability of them. A value of coefficient has between 0 and 1. The higher value of coefficient, the higher reliability is. In general, if a value is between 0.8 and 0.9, it is considered as very high reliability. In addition, if a value is 0.7, it is considered as desirable.

Firstly, the mean value method is used to calculate and identify the importance and weight of the KEs and KPIs of P&A from the survey data (in upstream O&G construction projects) and also to discuss the similarities and differences between the literature review and the findings. Moreover, Kendall's coefficient of concordance (W) is also used to determine the ranking of the KEs and KPIs of P&A in terms of the perception of different parties depending on different type of organizations: client, rig-owner/operator, main-contractor and sub-contractors/suppliers. Furthermore, it is also used to observe the difference ranking of the KEs and KPIs of P&A between people have experiences in working on P&A projects and people do not have experiences in working on P&A projects (i.e. between P&A experience group and No P&A experience group); how P&A experience affects the raking of the KEs and KPIs of P&A.

3 Literature Review

In this chapter, the comprehensive literature review is elaborated to drawn on knowledge from published in literatures and gain experience from different experts in the field and case studies: benchmarking and continuous improvement, performance measurement and performance indicators, difference views of project management and project success, characteristic of construction and O&G projects and relationship-based contracting (partnering and alliancing).

3.1 Benchmarking and Continuous Improvement

Benchmarking is a versatile improvement tool, and its core principle is to compare with other organizations and learning from their best practices, instead of trying to figure out on by themselves. It helps an organization how to solve a problem and then improve it (Andersen, 2015).

3.1.1 What is Benchmarking and Why?

Andersen and Pettersen (1995) provide a definition of benchmarking; *"the practice of being humble enough to admit that someone else is better at something, and being wise enough to learn how to match and even surpass it. (APQC, cited in Andersen & Pettersen, 1995, p. 3)"*

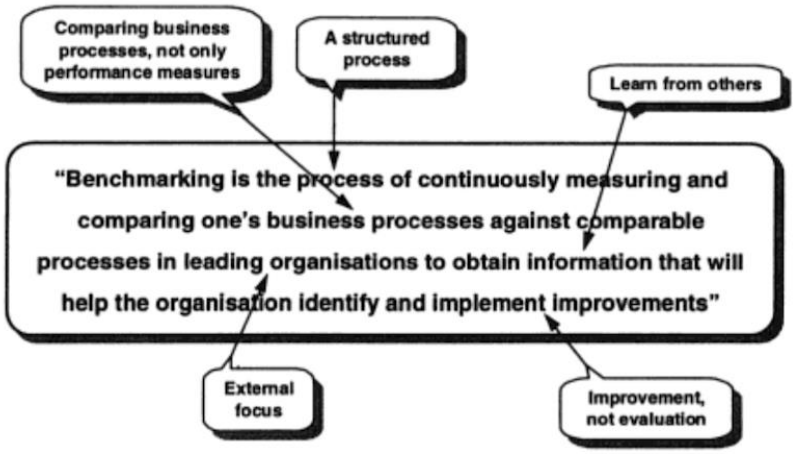

Figure 1 Operational definition of benchmarking (source: Andersen & Pettersen, 1995, p. 4)

To be carried out as defined, benchmarking has five core principles: measurement, comparison, improvement motivation, learning, and improvement. First, benchmarking enables an organization to measure a current status of other organizations: owner and partner's performance for comparison and improvement tracking. Second, benchmarking helps an organization compare its measured-data (e.g. performances, processes, support system, etc.) with other organizations' (e.g. competitors and/or the same line of business). Next, "benchmarking" what other business competitors have accomplished motivates improvements. Forth, benchmarking itself facilitates learning process from the benchmarking partners i.e. their best practices. Lastly, benchmarking helps an organization make improvements reaching the ultimate goal of any benchmarking study – even further or advanced levels (Andersen, 2015; Andersen & Pettersen, 1995).

Bhutta and Huq (1999) add that benchmarking is a process to establish the ground for creative breakthroughs. The most effective vehicle to ensure continuous improvement is to focus on the basic processes that run the organization. It is the concentration that will deliver the outputs that will achieve the organization's objectives, priorities and mission (Bhutta & Huq, 1999, p. 254). In this context, Sekhar (2010) stresses that benchmarking is an effective management tool to identify modified ideas and brings changes to achieve continuous improvements in relation to an existing activity, function or process improvement and re-engineering. In relationship contracting, Yeung et al. (2009b) highlight that benchmarking is considered as a vital tool for performance measurement that senior executives and project managers can use as a guideline to measure, monitor and improve the performance of their individual relationship-based projects.

Why does an organization need benchmarking? Many authors argue prior to transferring experiences and/or best practices if it is necessary to define and find this because transferring experiences and best practices cannot be transplanted as a plant. It should be carefully adapted regarding an organization's process and its style such as a surgical implant or organ transplant. If not, it will cause rejection of its implementation and adaptation - it would not serve its purpose - the best thing you can get is sub-optimization or dysfunction (Andersen, 2007, 2015; Bhutta & Huq, 1999; O'Dell & Grayson, 1999). For example, Beger (1997) and Jones (2012) use examples to explain how transferring concepts from one cultural and organizational context to another can lead to (more or less) failures. The Japanese concept of Quality Control Circles (QCC) was one of the backbones of the success, but failed to contribute to any

sustained improvement process when introduced in the West (Beger, 1997). In addition, how national culture can have an impact on the success of partnering upon the willingness of parties to voluntarily adhere to the principle of their agreement; partnering was successful in Japan, however, more or less a failure in Australia (Jones, 2012). Therefore, benchmarking, a continuous process, follows a systematic approach i.e. PDCA cycle. It is an effective and great tool not only for transferring methods/practices and its implementation, but also for its improvement. However, on one hand, it is important to note that benchmarking should be used as a guide or tool, not for any statistical precision (Andersen, 2007, 2015; Bhutta & Huq, 1999).

How does benchmarking work in the construction and the O&G industry? Swan and Kyng (2004) highlight that key performance indicators (KPIs) are the best-known examples of benchmarking within the construction industry. The authors illustrate that different ways in which benchmarking is used and available common measures. These different measures fall into one of several categories depending on what they are designed to measure:

- Building Performance – e.g. environment performance, design quality
- Project Performance – e.g. time, cost, defects
- Organizational Performance – e.g. health and safety, respect for people
- Relationship Quality – e.g. customer satisfaction service

However, in the offshore industry, Fouché and Rolstadås (2010) demonstrate that benchmarking and PM have not consistently used at a detailed level, conceivably due to the "one-of-a-kind nature" of the work, as opposed to continuous production processes. However, the authors argue that there is no intrinsic quality concerning the nature of the work that excludes the use of PM for project-oriented production processes. A lot of the heavy manufacturing industry produces in batches or as one-of-a-kind. These processes are a nature similar to the offshore fabrication processes. The authors illustrate that the individual project life cycle comprises several distinct, but core processes are inter-related (e.g. progress from engineering through procurement and fabrication to installation and commissioning). The inter-relationship between core processes/activities is significant since the transfer of deliverables from one phase to the next may strongly impact the premises' performance, depending on the quality and timing of the deliverables. Since the production processes in

projects are not continuous, all the core processes in a project should be measured in order to provide a complete picture of project performance.

3.1.2 What is Continuous Improvement and Why?

Bhuiyan and Baghel (2005) provide a general definition for Continuous Improvement (CI). *"A culture of sustained improvement targeting the elimination of waste in all systems and processes of an organization. It involves everyone working together to make improvements without necessarily making a huge capital investment (p. 761)."*

A number of management thinking and methodologies of CI have developed based on a basic concept of quality and/or process improvement, such as just-in-time (JIL), total quality management (TQM), business process re-engineering (BPR), lean, six sigma, balanced score card, etc., to achieve continuous improvement in an organization (Andersen, 2007, 2015; Bhuiyan & Baghel; 2005, Bond, 1999). These concepts form the basis of the Plan-Do-Check-Act (PDCA) cycle, which is also known as the Deming circle.

Why is the continuous improvement important? One argument provided by Andersen (2007) in a business process improvement context. The author remarks that without maintenance and improvement the performance level tends to decrease over time unless forces are exerted to maintain it. It is not only related to human nature that always craves for the better, but also other forces (both internal and external) have improvements to become a necessity in today's marketplace. For example, if an organization does not make an effort to improve, competitors would probably take over the organization's place. In addition, customers today have high expectations and are quite demanding. If an organization fails to meet these expectations, it is obvious that the organization will lose the customers.

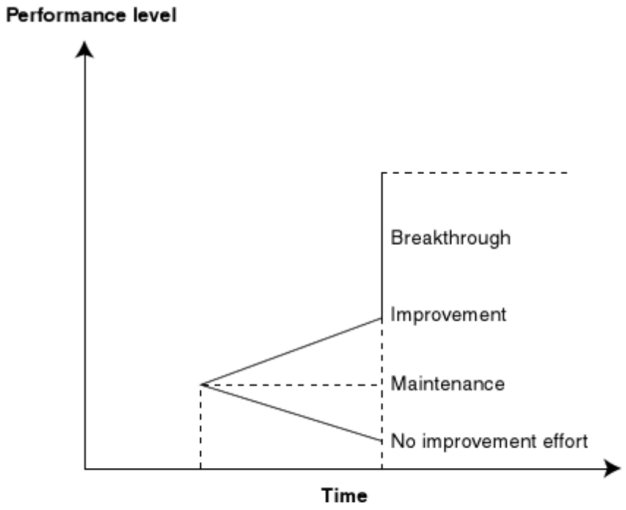

Figure 2 Without effort and/or improvement, performance level will decrease over time (source: Andersen, 2007, p. 3)

Kaye and Anderson (1999) argue that today's business environment changes rapidly characterized by uncertainty and unpredictability. In response to cope with these challenges, the authors illustrate that an organization needs 'a fifth quality ear – competitive continuous improvement'; the primary concern is with the organization being flexible, responsive and able to adapt quickly to changes in strategy in the light of feedback from customers and from benchmarking against competitors. For an organization to achieve flexibility, responsiveness and the ability to adapt quickly to changes within its environment, the implementation of a sound strategy for continuous improvement is essential (p. 2).

Other arguments can be related to critiques of P&A approach. While many researchers and authors espouse to positive results of P&A, others cast doubts on and even present critiques of P&A; by pointing out its pitfalls, limitations and paradox - how things can go and turn out to be wrong- regarding characteristics of projects as well as changing circumstances in projects e.g. uniqueness, cultural aspects, complexity, uncertainty, risk, ambiguity, etc. (Bresnen &Marshall, 2002; Bresnen, 2007; Eriksson, 2010; Merrow, 2012). Moreover, there are a number of challenges to implement P&A approach and undertake P&A projects (Aarseth et al., 2012; Adnan et al., 2012; Chan et al., 2003; Eriksson, 2010; Farrell et al., 1996; Herten & Peeters, 1986; Ingirige &Sexton, 2006; Suprapto et al, 2015; Winch, 2012).

3.2 Performance Measurement (PM) and Performance Indicators (PIs)

Performance measurement and performance indicators are a valuable tool to diagnose and measure the current status of performances, processes, activities, etc., in an organization. In other words, PM and PIs are an instrument panel, which indicate e.g. “where we are”, “what is a/the problem” and “where to fix and go (direction)” in an organization (Andersen, 2007; 2015, Andersen & Fagerhaug, 2002).

3.2.1 What is Performance Measurement and Performance Indicators and Why?

Andersen (2007) provides two arguments to define performance measurement (PM) in the context of a business process improvement. One argument is that PM is for the importance of process modeling to improve an aspect; an organization needs to know the current state of things. The other general argument is that in order to improve a process, an organization must know how well the process is being performed today. The important purpose of PM is to provide employees with feedback on the work they are doing. The role of PM is an instrument panel, which provides information and data that indicate or tell an organization; what is the problem, what should be done to fix and then improve it. Moreover, it helps an organization to prevent recurrences of the problem (Andersen, 2007, 2015; Andersen & Fagerhaug, 2002).

Andersen (2007) introduces a list of different application areas for PM to be used in organizations. Benchmarking is one of the application areas using PM to make improvement in organizations. The author illustrates that performance measurement system (PMS) is an integral part of a business process improvement system. If an organization wants to take continuous improvement, it needs to have proper procedures for periodic measurement of important performance aspects.

A performance indicator (PI) and/or key performance indicator (KPI) is a type of performance measurement (PM) and is also called a performance index, metric and/or measures. It is a valuable tool to diagnose and measure the current status of performances, activities, business processes, etc., in an organization (Andersen, 2015; Andersen & Fagerhaug, 2002). Andersen (2007) illustrates different types of performance indicators (PIs): hard vs. soft, financial vs. non-financial and leading vs. lagging indicators. The purpose of PIs is to evaluate and measure activities or processes in an organization in order to achieve its

strategic goals. PI is an index, which indicates the current status of an organization such as strength, weakness, etc. as well as gives an organization a chance to reinforce or alter strategic directions for successful management and continuous improvement of an organization (Andersen, 2007, 2015; Andersen & Fagerhaug, 2002).

PM and PIs are powerful and can be used for many different purposes including informed and collective "performance dialog". However, there are many challenges of using them, which should be used with caution - not to inadvertently stimulate dysfunctional behavior in an organization (Andersen, 2015). For example, inappropriate PIs may cause or bring dysfunctional behaviors - if an organization measures an employee or process in an illogical way, the employee or process would react/respond in illogical behavior (Bond, 1999). Therefore, it is essential to understand and consider "what is important to an organization" when determining PIs, so that PIs can reinforce activities/processes that are in the best interest of an organization. In this regard, Andersen (2007) adds that different types of performance indicators should be measured in a balanced manner. Moreover, "what is measured" must be stemmed from important strategic and stakeholder performance priorities to any measurement so that KIPs can act as right drivers for the future success of a project or an organization (Andersen, 2007, 2015).

3.3 Different Views of Project Management and Project Success

A traditional view on projects, the iron triangle (i.e. cost, time and quality) is considered the most important dimensions to measure success of a project in a project management context (Bjökegr, 1999). A project is divided into three different phases: planning, control and evaluation. The aim is to execute and control projects as actual plans by focusing on internal perspectives: individual project, individual task, and individual manager. However, the traditional view of project management has been questioned due to complexity in its implementation, uniqueness (project itself and tasks), etc. Hence, projects today should be considered "project as a temporary organization" focusing on expectation, action and learning rather than "project as plans" (Packendorff, cited in Bjökegr, 1999). In this regard, Ajmal and Koskinen (2008) add that most organizations today are managed and operated based on a unit; so-called "project-based organizations (PBOs)" to cope with complexity, uncertainty, risk, ambiguity, changes, etc. as well as to optimize scarce resources.

Aaresth (2012) demonstrates that project success has a broad range of definitions, which has often been context-dependent, is expressed different things to different people. In other words, it can vary from one project to another project and from one stakeholder to another stakeholder. The most quoted success factors are related to managing organizational challenges such as the importance of getting supports from senior management, good communication, stakeholder involvement, clear objectives and a detailed plan in projects. I this respect, Chan and Chan (2004) provide a consolidate framework for measuring project success from a literature review. In addition to time, cost and quality, other project success criteria are included: commercial profit and value, environmental performance, user expectation and satisfaction, and participants' satisfaction.

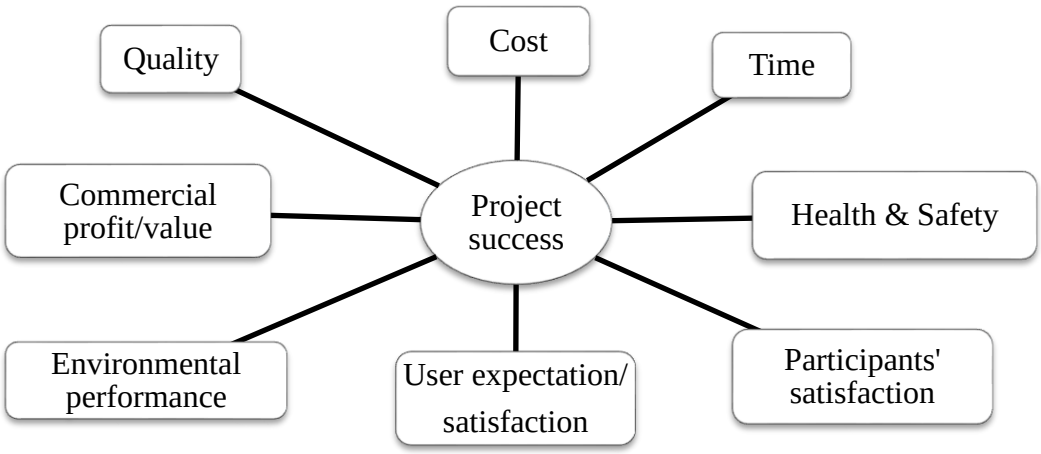

Figure 3 Consolidate framework for measuring project success

3.4 Characteristics of Construction and Upstream O&G Construction Projects

Construction and upstream oil and gas (O&G) construction projects today are referred to as industrial megaprojects (Merrow, 2012; Winch, 2012), which are characterized by high project costs, duration (time), size/scale of projects, complex procurement processes, numbers of participants in projects, etc. The involvement of stakeholders and technological developments increase complexity, uncertainty, risk and frequency of changes in projects (Naoum, 2003; Winch, 2012).

Both (construction and upstream O&G construction) projects share common grounds. First, for instance, both projects are labor-intensive and unique (i.e. one-of-a-kind). In addition, operational locations change from one project to another project. Moreover, production condition is not stable due to weather conditions, geological and technological challenges, etc. Lastly, procurement and supply chain relations also differ from one project to another project (McKenna, 2006; Andersen, 2015b).

In a supplier relation context, Håkansson and Gadde (1993) illustrate general characteristics of buyer-seller relationships for professional purchasing, based on an industrial network theory. The six general characteristics are: complexity, relationship as long-term investments, adaptation, reciprocal trust rather than contracts, power and dependence, and both conflict and co-operation. The authors assume that relationships always exist, but are more or less sensibly utilized. The buyer-seller relationships can be varying from very simple (e.g. one to one) to very complex (e.g. multiple functions, multiple parties). The authors point out that the

relationships are social processes and supplier relations can be a critical resource to manage projects. Therefore, in order to establish an effective relationship, it is important to understand different characteristics of relationships, for instance, conflicts are not suppressed, but allowed to surface and then to be handled constructively. Halman and Braks (1999) state buyer-supplier relationships in the offshore industry from the buyer's perspective. "Temporary partnering and alliances" projects are more and more applied, due to the characteristic of the temporally basis of the cooperation in the offshore industry. In order to explore marginal fields, operating O&G companies have introduced the "alliancing concept", because there are a number of fundamental challenges that can threaten future prosperity such as a lower oil price resulting in a reduction of revenues and marginal O&G fields resulting in a lower return on investment (ROI). The authors highlight that in order to realize win-win situation, all parties have to negotiate about the interests of what they are willing to take and share a project risks and rewards.

Olsen et al. (2005) illustrate that building a new offshore oil platform or rebuilding an existing one is a rather complex type of procurement involving several contractors, sub-contractors and vendors, such procurements consist of four phases: engineering, fabrication, installation and commissioning. The authors demonstrate that due to technological complexity and uniqueness of each new offshore platform, exchange setting and conditions between the operator (O&G company i.e. buyer) and the contractors can be labeled hazardous. A key managerial challenge is to find and apply suitable contracts or governance arrangements that are capable of coping with these exchange hazards.

Table 1 Four phases of procurement process in oil and gas industry (source: Olsen et al., 2005)

Engineering	Fabrication	Installation	Commissioning
• Plan • Specification	• Procurement • Production	Different parts are installed and then on a platform	Moved to specific locations and commissioning

3.5 Relationship-Based Contracting (RBC)

Jefferies et al. (2014) indicate that there has been a significant global increase in the use of "relationship-based contracting" approaches in construction projects with strategies such as "partnering and alliancing". Relationship contracting is defined as follows:

> *Relationship contracting embraces and underpins various approaches such as partnering, alliancing, joint ventures and other collaborative working agreements and better risk sharing mechanism. Relationship-based contracts are usually long-term, develop and change over time and involve substantial relations between parties (Walker & Rowlinson, cited in Jefferies et al., 2014, p. 466)*

Relationship contracting is based on the recognition of mutual benefits, a win-win scenario and better risk sharing mechanism through more cooperative relationships with all parties involved in projects. The desired results are cost reduction, shortened duration and an improvement in the quality work of projects (Jones, 2012; Davis & Love, 2011; Jefferies et al., 2014; Yeung et al., 2009b). Yeung et al. (2009b) add that relationship contracting embraces and underpins various approaches such as partnering, alliancing, joint venture and other collaborative working arrangements and better risk sharing mechanism. Relationship contracts are usually based on long-term. It develops, changes over time and involves substantial relations between parties. Moreover, Cheung and Rowlinson (2005) stress that relationship contracting has the potential benefits of achieving stakeholder empowerment, facilitating regional development and delivering a sustainable industry.

* In the UK upstream O&G industry, partnering and alliancing are referred to as "collaborative relationships" (Green & Keogh, 2000; Haque et al., 2004).

3.5.1 Partnering and Alliancing (Project and Strategic)

Project partnering was introduced by the US Army Corps of Engineering to avoid construction disputes and pursuit joint workshop practices in 1988. A partnering charter and a decision ladder, or a problem escalation ladder, is used as a management tool to resolve conflicts (Clay et al., 2004; Lahdenperä, 2012). It is a collaborative/management approach based on traditional contractual frameworks in an early form of partnering, such as design-

bid-build or design-build. However, practices of partnering have evolved, and a new contractual practice has developed today, making project partnering concept more blurred in general (Lahdenperä, 2012; Walker et al., 2002). As a result of its positive experience, it was introduced to the UK, Australia, and widely spread to the continent (Lahdenperä, 2012; Sakal 2005).

The Latham Report (2015) defines Partnering as:

> *A broad term used to describe a collaborative management approach that encourages openness and trust between parties to a contract. The parties become dependent on one another for success and this requires a change in culture, attitude and procedures throughout the supply chain. It is most commonly used on large, long-term or high-risk contracts.*

The Construction Industry Institute (CII) (1996) defines two categories of partnering: "project partnering" is for a single project and a short-term collaborative relationship whilst "strategic partnering" is for multi-projects and long-term collaborative relationship in the partnering toolkit report. Aarseth et al. (2012) also provide definitions of two categories of partnering: "project partnering" and "strategic partnering". The former aims to improve performance over the life cycle of a single project. The latter focuses on obtaining a competitive advantage over the long period to foster long-term relationship. Naoum (2003) illustrates that it has been termed as "strategic partnering" by bringing all parties to a project in a framework of trust and cooperation. The principle of partnering encourages all the parties to consider continuous improvement to the work process. Bresnen (2007) quotes Bennett and Jayes's statement to elaborate the evolution of partnering;

> *It is a new, second generation of more sophisticated partnering arrangements is developing in construction that represents more intense, long-term collaboration between clients and contractors then anything previously seen (Bennett & Jayes, cited in Bresnen, 2007, p. 367).*

In this sense, Spang and Riemann (2014) illustrate three different levels of partnering: (1) first generation partnering - project partnering, (2) second generation partnering - strategic partnering, (3) third generation partnering - system partnering (p. 220).

British Petroleum (BP) encountered too many uncertainties (e.g. smaller size oil reserves and a need for the latest technology) that could jeopardize the project success by cling on the existing contract methods during "The Andrew Field Project". So, BP's project team developed the original alliance approach (i.e. project alliancing) in 1992 in the North Sea (Halman & Braks, 1999; Sakal, 2005; Spang & Riemann 2014).

Farrell and McDermott (1995) define a difference between partnership and alliance as:

> *Partnerships and alliances are arrangements, which include as structure to share reward and /or risk between an operator (oil and gas company) and contractor(s). If the risk/reward relationship is between an operator and a single contractor, it is called partnership. If there is interlocking risk/reward among multiple contractors and the operator, it is called an alliance (p. 590).*

Project alliancing, built on the notion/ethos of partnering, is a relational contract mechanism and involves an open-book accounting approach, sharing risk setting and initial target cost generated by the whole project team (Sakal, 2005). As a result of its successful experience, it was introduced in O&G projects in Australia in 1994 and in the construction project in 1997 (Lahdenperä, 2012; Sakal, 2005).

In terms of structure and culture of alliance, alliance board (AB) is established to support and guide project management team, ensure commitment of all parties in projects and facilitate effective communication. Alliance/project management team (PMT/AMT) manages the engineering process so that the targets are achieved. An alliance agreement defines targets, risk and reward mechanisms, and the inter-relationship of different contractors (Halman & Braks, 1999). Project alliancing aims a more effective integration of resources, encourages all parties to work closely and re-defines the boundaries. Unlike other contracts, it is structured as a more or less flat organization; an alliance board acts as steering committee, project management team and contractors (Halman & Braks, 1999; Olsen et al., 2005). Certain elements within alliances differ from one project to another project; however, in order to maximize the probability of success for all alliances, projects should have characteristics such as risk and reward sharing mechanism, an alliance board and minimizing litigation issues. In addition, a team makes decisions for "the best interest of the project" (Ross, cited in Sakal, 2005).

Jones (2012) illustrate that program alliance, also known as strategic alliance, shares some fundamental characteristics with the project alliance. It is conceived as a long-term relationship between participants, enduring beyond any single project. This form of relationship contracting is appropriately employed when the owner requires the performance of routine and ongoing work, or a series of similar or related projects, and seeks to develop a close and long-term relationship with the contractor who assumes these responsibilities (Jones, 2012). Walker et al. (2013b) introduce another form of alliance in the construction industry, which is a service alliance (SA), used for outsourcing the maintenance and operating facilities such as buildings, roads, rail track, water distribution, etc.

3.5.2 Partnering vs. Alliancing

Authors argue that there is no universally agreed definition of partnering or alliancing; moreover, it is commonly used without any distinction or difference between partnering and alliancing that cause confusion (Eriksson, 2010; Winch, 2012). In this respect, Ingirige and Sexton (2006) believe that in the construction industry, the term "partnering" has been used interchangeably with alliancing (Li et al., cited in Ingirige & Sexton, 2006). However, Walker et al. (2002) states that alliancing, which is more "all embracing" than partnering, as its means of achieving an integration of objective among project teams. The authors clarify the important distinction between partnering and alliancing i.e. contractual agreements. Partnering aims agreed goals, and dispute resolution and escalation plans are established. However, partners still retain independence and may individually suffer or gain from the relationship. The contractual relationship between a client and contractor is similar to a traditional contract. However, alliancing, where parties form a cohesive entity, jointly shares risk and rewards to an agreed formula. For example, if a project is delivered one day late, all partners jointly share the penalty. Rewards are likewise awarded for successfully exceeding expectations. The contractual agreements are significantly different. Thus, in partnering, there is no partnering contract, only a "partnering charter" that is non-binding while there is an alliance contract in alliancing. (Jones, 2012; Yeung et al., 2009a). Another notable difference between partnering and alliancing is that alliancing is "joint", while partnering is "shared" commitment (Walker & Hampson, 2008; Yeung et al., 2009b). Jones (2012) and Yeung et al.

(2009a) add that alliancing is a type of virtual corporation, which is not legally integrated, but works cooperatively to achieve desired outcomes.

Walker and Hampson (2008) provide vital components of the relationship that differentiates alliancing from partnering from studies (or at least those more committed levels of partnering). These elements generally fall into the following categories (p. 46):

- Level of trust and commitment
- Degree to which the relationship is planned and nurtured rather than forced or required as a condition of contract
- Way in which the relationship is initiated, fostered and maintained as part of an integrated procurement process
- The degree to which transparency/open-book philosophy is maintained
- The way in which risk and reward are treated

Yeung et al. (2007) point out that sustainable development ought to be viewed as a desirable goal and outcome of alliancing. The authors identify that "formal contracts" as defining elements of alliancing, which is both a relationship management system and a delivery system, partnering is not a delivery system (p. 223). Cheung et al. (2003) illustrate that the concept of partnering is described as a generic term of management approach to align project goals in Hong Kong construction. The goal for partnering is to improve relationship among contracting parties, either in single project partnering or in long-term strategic alliances.

To conclude, P&A evolves in the course of time, and practices differ from one project to another as well as country. The terms and certain elements can be different in practices. However, the main principles of P&A concern with relationships among parties in order to perform successful projects, as opposed to the traditional contracting methods, which only focus on transaction; the fulfillment of performance each party. In addition, P&A shares common grounds in relation with pursuing an integration of a project progress and project team. Therefore, P&A can be named "relationship-based contracting". In the light of the arguments above, this thesis elaborates the discussion and research from a perspective, which does not distinguish between P&A.

Table 2 The notable differences between Project vs. Strategic and Partnering vs. Alliancing (source: adapted from the literature review)

	Partnering	**Alliancing**
Project (One-off)	• Contract (traditional or relational) • Non-binding partnering charter (e.g. decision ladder)	• Formal contract (usually relational) • Alliance agreement
	• Compensation form • Incentive regulation	• Risk and reward mechanism
Strategic (Long-term)	• System partnering (3rd generation)	• Program alliance • Service alliance
	• Long-term relationships that sustain over more than one project • Continuous improvement	

3.5.3 Limitations and Pitfalls of Partnering and Alliancing (P&A)

Bresnen and Marshall (2002) throw two questions regarding P&A. The first question is whether or not P&A actually reflects a deep-rooted change in attitudes within the industry, as opposed to a more calculated and superficial response by contractors to particular market conditions. Another question is how cultural changes can be brought about, given what we know about the subtleties of organizational culture and the complicating effects of contractual relationships. In this regard, Bresnen (2007) argues that more critical views and problematic aspects of P&A need to shed light on project environments by demonstrating how "the seven pillars of P&A" can turn out to be paradox – and even deadly sins of P&A.

Table 3 Seven pillars, seven paradoxes and seven deadly sins of P&A (Source: Bresnen, 2007)

Seven Pillar	**Paradoxical effect**	**Deadly Sin**
Strategy	Wishful thinking about strategy and behavior	Sloth
Membership	Fostering of relationship built on exclusivity	Lust

Equity	Encouraging exploitation and opportunism	Avarice
Integration	Reinforcing a desire for control	Gluttony
Benchmarks	Setting of inappropriate targets	Envy
Processes	Over-engineering of processes	Wrath
Feedback	Failing to capture knowledge and learning	Price

Alderman and Ivory (2007) also point out the contingent nature of the P&A process due to changing commercial pressures - how quickly clients can lead to the abandonment of P&A. Particularly, the authors criticize the vulnerability and fragility of P&A relationships from suppliers' positions. They argue that appropriate strategies should be arranged for the suppliers as well, rather than "buying them into" P&A. They suggest taking flexible and critical view of what is appropriate at any given moment in the project process. Aarseth et al. (2012) adds that presented models and empirical evidences in literatures regarding discussions on P&A limit only focus on perspectives of the owner and main contractors, excluding suppliers and vendors' stances. In this context, other authors also argue that P&A should not be "buying-in or mere puff " (Alderman & Ivory, 2007; Cheung et al., 2003a).

According to Winch (2012) and Suprapto et al. (2015), Merrow (2011) argues that P&A contracts are the worst, while "mixed" contracts (e.g. a reimbursable and separate fixed price contracts) are the best. Winch (2012) demonstrates the reason of Merrow's argument from the book review; some of P&A contracts often tend to be understaffed and poorly integrated owner teams. The "rhetoric" of P&A encourages owners to believe that contractors can do the owner's work. Therefore, "mixed" forms of contracts work best; separations of design and execution, making interfaces clear and encouraging the owner to engage with front-end planning (Winch, 2012, p. 706). However, based on their case study, Suprapto et al. (2015) assert that P&A contracts and incentives do have a positive influence on projects in terms of performances compared to traditional contracts (e.g. fixed-price and reimbursable contracts), but the authors stress that P&A contracts come at a price. In addition, P&A contracts cannot improve performance of projects by itself; there should be recognition and active participations from both senior management and project managers. This argument can be related to the one presented by Bresnen and Marshall (2002). The authors argue that P&A by

itself does not necessarily solve some of the problems that it is set up and designed to cope with. The authors stress that P&A are clearly no panacea and do not provide the means of resolving such problems at source. It is important to be aware of not only the strengths, but also the limitations of P&A.

Several authors give critiques in terms of incentive schemes in P&A (e.g. compensation model, risk and reward mechanism). Farrell et al. (1996) warn of misused incentives. Setting the targets for incentives should be fair and achievable. If not, P&A team will have no motivations to change behavior and work with others to reduce cost or improve schedules. The authors stress that setting unrealistic targets is not worth of attempting/trying. No matter how great incentive schemes will be, it can never make a project attain something unachievable. Herten and Peeters (1986) also warn that incentives must be used with a caution. It can be an efficient tool for the client to balance costs and to meet performance and schedule requirements. However, sufficient considerations should be made on incentives regarding different interests of actors in project. In other words, contractors will act differently upon incentives depending on their interests and capabilities; the purpose of incentives may go wrong directions. Although incentive contracts (P&A contracts) are only a good tool, it is impossible that a good incentive scheme could lead bad project management to good one.

Other researchers and authors investigate factors that successfully influence implementation of P&A. Aarseth et al. (2012) address difficulties in implementing of P&A are related to the lack of shared understanding of key P&A concepts, missing initial effort to establish shared ground rules, communication difficulties inter-organizational relationships and unclear (perceived) roles and responsibilities). Adnan et al. (2012) also add factors influencing conflict in P&A: relationship problems, distrust, failure of sharing risk, culture barriers, communication problems and lack of continuous improvement. Chan et al. (2003) indicate critical problems for implementation of P&A in construction projects: misunderstanding of P&A concept, relationship problems, culture barrier, uneven commitment, communication problems, lack of continuous improvement, inefficient problem solving, insufficient efforts to keep P&A going and discreditable relationships. Ingirige and Sexton (2006) investigate initiatives and barriers for long-term collaboration in P&A. Their study reveals that the longer-term aspects of collaboration in construction P&A projects are neither adequately appreciated nor understood in practice or in theory. The research addresses the value of long-

term collaboration and improving effectiveness and efficiency of interactions between construction participants to improve knowledge sharing. Farrell et al. (1996) identify and highlight pitfalls of P&A: misalignment of goals, weak or uncommitted partners, unachievable targets, policies and procedures, bureaucracy, complacency and regressive behavior based on lessons learned on international P&A contracts.

3.5.4 Key Elements (KEs) of Partnering and Alliancing (P&A)

In this section, a total number of 16 key elements of partnering and alliancing (P&A) such as important/main principles, concepts, success factors, components, elements, etc., are elaborated from the literature review.

1) Trust

Trust is the most pivotal attitudinal factor, which underpins P&A. Cheung et al. (2003b) exemplify the concept of prisoner's dilemma to elaborate the important aspect of trust, which is an attitude of human acts or beliefs, is "reciprocal" and needs to be "earned". Trust represents a favorable interpersonal or inter-organizational relationship, and it is an important element in a long-term stability of members of an organization. Chan et al. (2004) suggest having mutual trust toward other partners for P&A to work. Partners should have the belief that others are reliable in fulfilling their obligations in an exchange relationship. It is essential to "open" the boundaries of the relationship because it can relieve stress and enhance adaptability, information exchange, and joint problem solving, and promise better outcomes. Crowley et al. (1995) stress that trust develops confidence and encourages open communication, exchange of ideas and sharing of resources.

2) Conflict and Problem resolution

Conflict and problem resolution will provide a procedure to prevent conflicts/problems and to help solve them before reaching litigation issues; disputes are seen as "our problems" not "your problem" (Crowley et al., 1995; Spang & Riemann, 2014). Aarseth et al., (2012) stress that resolution should be discussed at an early stage to make sure those conflicts will be taken care of during the project life. Chan et al. (2004) point out that such resolution should be productive, otherwise it would cause counterproductive effects such as coercion and confrontation, in turn, fails to reach a win-win situation. In fact, conflicting parties look for a

mutually satisfactory solution, and this can be achieved by a joint problem solving to seek alternatives for the problematic issues.

3) Effective communication

Chan et al. (2004) emphasize that P&A requires timely communication of information and the maintenance of open and direct lines of communication among all project team members. Problems on the site need to be solved immediately at the lowest possible level. If communication is used only for routine matters while important issues are conveyed from each site office to the respective head offices and then go back to the site office before any interactions, P&A will fail. It is clear that effective communication skills can help facilitate the exchange of ideas and visions and overcome difficulties. Spang and Riemann (2014) emphasize different information can lead to mistakes and even to conflicts between parties. IT system (web-based management system) can facilitate free information flow among parties (e.g. contractors, suppliers). Of course, appropriate assignment of assess rights (e.g. who just read or read and write) is a precondition. Walker et al. (2002) recommend the use of shared IT system and information processing integration to achieve "excellence in communication at all levels": a personal, business and operational levels and to promote an integration of the project team. In this regard, Segil (2004) highlights that communication protocol – both external and internal is a key element for smooth management of P&A.

4) Commitment

Chan et al. (2004) emphasize that commitment and support from top management are always prerequisites for successful P&A projects. As senior management formulates the strategy and direction of business activities, full supports and commitment of the senior management are critical in initiating and leading the P&A spirit. In addition, long-term commitment can be regarded as the willingness of the involved parties to integrate continuously to unpredicted problems. More committed parties are expected to balance the attainment of short-term objectives with long-term goals and achieve both individual and joint missions without raising the fear of opportunistic behavior. Crowley et al. (1995) believe that long-term commitment allows constant improvement of technology and methods. It reinforces the mutuality of the parties, and reduces the rivalry of the traditional contracting system, reduces the likelihood of litigation and produces feelings of camaraderie among parties.

5) Mutual vision and objectives and goals

Crowley et al. (1995) illustrates that shared vision is a set of common project objectives formed by consensus through open expectations established within an open environment. Walker et al. (2002) exemplify the National Museum of Australia project to explain that the core principle of P&A was to achieve a positive outcome for all P&A members through shared commitment to common goals and objectives of a project realization delivering best value to the client and acceptable reward outcomes to alliancing members.

6) Continuous evaluation and improvement

Aarseth et al. (2012) highlight that it is important to keep in mind that P&A process is a "living entity" in continuous development, and it needs to be nurtured to function optimally. In addition, "relationship" is an important feature of P&A, which should be established, strengthened and sustained. As part of this process, it is imperative to make sure that the relationship with key stakeholders is healthy. Moreover, continuous evaluation must be made regularly to ensure the P&A process and the P&A relationships are sound and accord with its plan to detect "early warning signs" before it goes wrong. Walker and Hampson (2008) emphasize that other dimensions of the essential features of P&A are commitments to continuous improvement, which enable innovation. Performance is measured and analyzed to provide knowledge about how improvement can be achieved continuously. There must be a commitment to learn from experience and to apply this knowledge to improve performance. So as to achieve results on time and to fulfill specification requirements, innovation will always be required to improve the current process (Yeung et al., 2007).

7) Risk and Reward sharing mechanism

Crowley et al. (1995) illustrates that shared risk implies that uncertainties of a project life are jointly shared among the parties. Walker et al. (2002) add that a bonus reward mechanism to be shared by all parties is jointly established to encourage further innovation excellence. In this regard, Spang and Riemann (2014) highlight that risk and reward mechanism brings a "win-win situation" for a client and contractor. For instance, the client can use the contractor's competence to optimize his/her project in his/her sense (quality, functionality or cost) and the contractor, in turn, can achieve a bonus for bringing in good ideas and/or better performance. Fair and equitable risk and reward (i.e. incentive) mechanism act as a motivation for contractors to achieve better outcomes. In addition, risk and reward mechanism

under “an open-book accounting approach” can increase motivations by being transparent – building and earning more trust (Eriksson, 2010; Walker & Hampson, 2008; Lloyd-walker et al., 2014; Spang & Riemann, 2014; Walker et al., 2002).

8) Cooperation and Collaboration

Aarseth (2012) highlights that it is vital to increase understanding of cooperative power in P&A approach to deal with organizational challenges such as communication, collaboration and integration in projects. Walker et al. (2002) illustrate that cooperation and collaboration among the parties can make synergy effects in terms of achieving improvement and innovation (and even breakthrough) in P&A projects. The authors advocate reaching “coalescence” stage beyond cooperation and collaboration. In this regard, Walker and Hampson (2008) address that P&A is on the stage of cooperation and also suggest pursuing to reach “collaboration – calescence” stages to maximize potential benefits for not only management of a project, but also all parties involved.

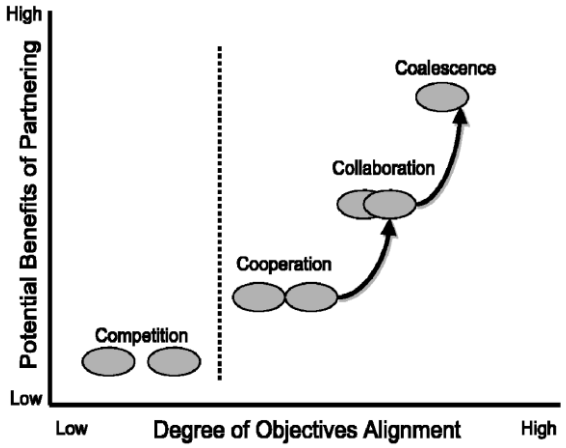

Figure 4 The project continuum (source: Walker & Hampson, 2008; Walker et al., 2002)

9) Partnering and Alliancing tools

Cheung et al. (2003a) illustrate that various forms of P&A tools have been developed and used to accomplish desired outcomes including workshops, review meetings, team-building exercises, incentive and social function. The main purpose of these tools is to align objectives of contracting parties to have a common goal so as to create more cooperative and effective project team. Spang and Riemann (2014) recommend having special review workshops with all parties together regularly during undertaking a project, to ensure a know-how transfer (best practices/lessons learned) between them. This knowledge should help improve the actual and

all following projects. In addition, "facilitators" are also important the one who provide guidelines and solutions from a view of "the third persons" (Eriksson, 2010; Farrell et al., 1996); they join during a team building and working session. Although both internal and external personnel were deemed helpful, the outside facilitators were almost always viewed as more independent and neutral (Farrell et al., 1996). Moreover, "ongoing workshops" during P&A projects are found out to be useful to promote an integrated team and also for a contractor selection process. (Jefferies et al., 2014; Yeung et al., 2009a).

10) Win-win scenario

Authors emphasize the importance of increasing understanding of where "win-win" comes from; no party wins due to the other's loss (Crowley et al, 1995; Green & Keogh, 2002). This is based upon a paradigm shifting from "us and them" to "we all win or well all lost" mentality – "sink or swim together" (Jones, 2012; Walker & Hampson, 2008; Lloyd-walker et al., 2014). In this context, risk and reward sharing mechanism can be useful for facilitating "win-win scenario" to work among parties. Yeung et al. (2007) add that an equitable risk-reward balance aligns the commercial interests of parties.

11) Contractor selection

Contractors for P&A should be selected based on relevant experience, competence, past performances, innovation, capabilities, etc. rather than a low-bid selection (Jones, 2012; Walker & Hampson, 2008; Naoum, 2003; Walker et al., 2002; Lloyd-walker et al., 2014). Eriksson (2010) stresses that a bid evaluation (contractor selection) of P&A should be based on technical and managerial competence, collaborative ability, previous experience of the supplier and shared values. Yeung et al. (2007) add that one of the most innovative elements of alliancing is the "early" selection of contractors based on factors other than price. The client chooses contractors who seem to be the most able to provide "value for money".

12) Clear role and Responsibility

Unclear role and responsibility can raise disputes and conflicts (Spang & Riemann, 2014) because of the discrepancy in goals and expectations. And these conflicting issues are commonly observed among parties (Chan et al., 2004); if something goes wrong, a blame game starts all over again. Therefore, role and responsibility should be clear and at all times (Aarseth et al., 2012). Chan et al. (2004) indicate that it reflects the expectation of each party from the other parties in fulfilling a set of tasks. Good coordination resulting in the

achievement of stability in an uncertain environment can be attained by an increase in contract points between parties and sharing of project information.

13) Effectiveness of management board

Aarseth et al. (2012) assert that the management system should take care of P&A processes and the product because, for instance, late or wrong decisions also can be a potential factor of conflicts (Spang & Riemann, 2014). Management board and system have competence to support the P&A processes. In addition, in alliancing, there is an "alliance board" that plays an important role to lead a project and all parties to attain desired results effectively and efficiently. Therefore, management board should be unbiased and fulfill their tasks.

14) Early involvement and Empowerment

Naoum (2003) emphasizes that the most successful P&A arrangements have looked to integrate not only consultants and main contractors, but also key suppliers. Jefferies et al. (2014) stress the involvement of site personnel. The site personnel play an important role in P&A, and involving them in ongoing workshops builds trust, strong relationships and commitment that promote good workmanship and thus influence the overall success of P&A. Walker and Hampson (2008) emphasize that trust and empowerment are closely and powerfully linked to effective teamwork. An alternative term that is being used these days for empowerment is "enabling" which has a broader meaning for providing resources to enable people to achieve their goals and objectives. Building expert/information power is also an important aspect of relationship interactions for consultants, construction and project managers.

15) Flexibility to change and Change management

Changes (e.g. design phase) often occur in every project even if the scope/specification is well defined. Changes could be due to client/customer's requirements, geological and technological challenges, etc. Once a change occurs, this can lead to a chaotic situation and impede the progress of project since construction and upstream O&G construction projects are characterized by complexity and large number of participants. Spang and Riemann (2014) suggest that all stages which have to be passed during the change process be mentioned and described to specify *"who has to do what, in which way, until when" (p. 224)*. In additions, Jefferies et al., (2014) add that staging project and stretch target are critical success factors of P&A based on their case study.

16) No-blame culture

Walker et al., (2013b) illustrate features of a no-blame culture: good faith in acting with integrity in making best-for-project decisions, peer relationship, respect for other and their expertise (p. 6). The "no-disputes" and "no-blame" culture is vital aspect of P&A because this culture encourages parties to act on a "best for project'" basis. To do so, project participants should have no legal or equitable cause of action against any other participant unless it is "willful default" (Jones, 2012; Lloyd-walker et al., 2014). Lloyd-walker et al. (2014) and Walker et al. (2013b) argue that "no-blame culture" drives a collaborative behavior in P&A and innovation can be achieved through P&A in such culture.

3.5.5 Performance Measurement of Partnering and Alliancing (P&A)

Crane et al. (1999) points out a need to develop a system (e.g. performance measurement) so as to assess the current health of P&A relationships and monitor its progress. The reason is that, unlike other traditional or ordinary projects, P&A projects can be characterized behavioral aspects. These behavioral aspects of P&A are critical to achieve objectives of projects and lead projects to success. Cheung et al. (2003a) add that P&A relationships must use relationship measure to achieve a greater degree of foresight and realize the benefits of increased time to react to problems in the relationship.

Performance measurement requires time and resources. Therefore, an organization should carefully decide important areas for measuring and select effective ways of doing so (Andersen, 2007; Andersen & Fagerhaug, 2002). The best measure contains small quantity, and a simple measure, which sounds to the objective of P&A. In addition, performance measurement should be designed to support the objectives of a specific P&A relationship. An organization should be careful not to "over-measure" when establishing indicators to monitor and control relationships of P&A. To add, PM can be used for strategic adjustments, mid-course alterations or continuous improvement (Andersen, 2007; Andersen & Fagerhaug, 2002; Crane et al., 1999). In this context, "Objectives, Goals, Strategies, Measures (OGSM) branch" can be utilized in the development of PIs for P&A (Cheung et al., 2003a; Crane et al., 1999; Yeung et al., 2007b).

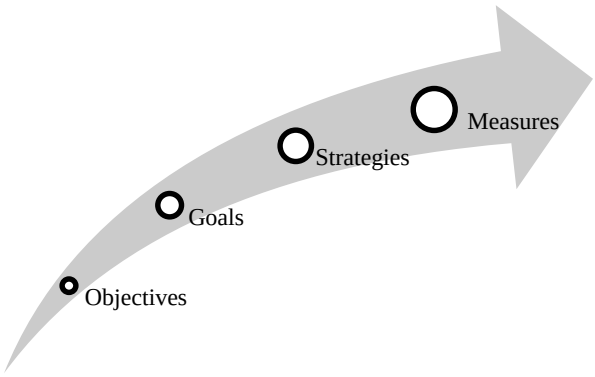

Figure 5 Objectives, Goals, Strategies and Measures (OGSM branch) (source: Crane et al., 1999)

Cheung et al. (2003a) illustrate that in order to assess the status of P&A, it is important to aware of the inter-relationship between goal, process, performance and feedback, which are four key elements to consist of P&A process as a system. The authors emphasize that indicators of P&A performance should be reflective of the project goals, as each P&A project requires a "unique set" of indicators.

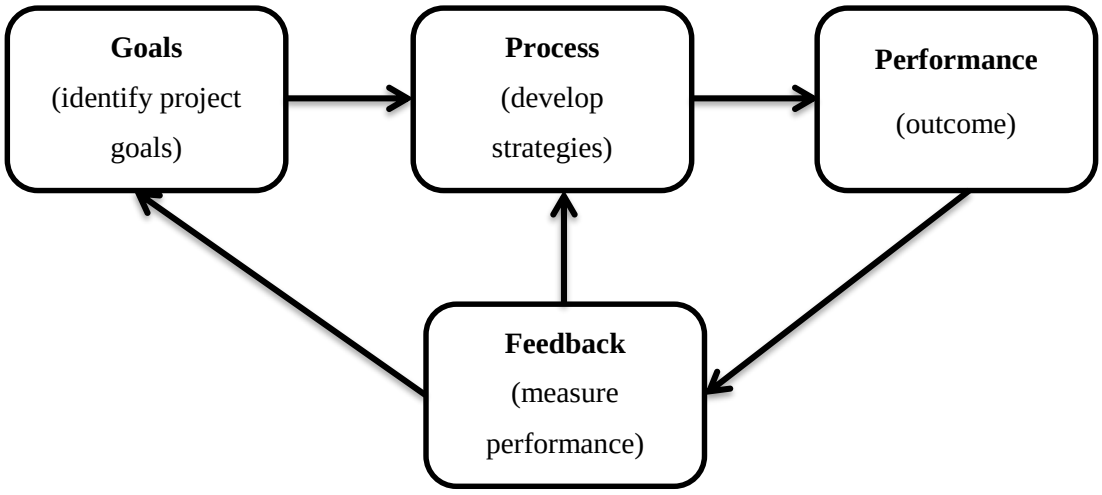

Figure 6 The interrelationship of P&A system (source: Cheung et al., 2003a)

There are three different types of PM for P&A: result, process and relationship. Result indicators are hard indicators, which measure how well project performances align with goals of projects such as cost, time, quality, etc. These indicators are useful to make strategic adjustments, however only result indicators do not provide complete pictures to assess and monitor performances (and relationships) of P&A (Andersen, 2007; Andersen & Fagerhaug, 2002; Cheung et al., 2003a; Crane et al., 1999). Process indicators are useful for tracking activities in progress. This provides an early warning system to identify necessary mid-course

alterations. Trouble areas can be corrected or adjusted in a timely manner by means of process indicators. Alterations, which are made early, tend to result in reducing project expenses and improving relationship between parties. However, process indicators have shortcomings because it is concerned with short-term and immediate impacts of problems in the process (Andersen, 2007; Andersen & Fagerhaug, 2002; Cheung et al., 2003a; Crane et al., 1999). Relationship indicators are referred to as soft measures, used to track the activities as well as effectiveness of P&A teams. Relationship indicators are often a set of subjective indicators that team members use to assess P&A relationships on a periodic basis. These indicators address important issues including the level of trust, the improvement of processes and the effectiveness of P&A relationships. It is essential that these indicators reflect the goals that were identified at the outset of relationships (Crane et al., 1999; Yeung et al., 2007b). Crane et al., (1999) gives an example of a survey that one organization used to measure the performance of P&A relationships (see appendix D). In this regard, Yeung et al. (2008) introduce quantitative indicators (QIs) and quantitative ranges (QRs) to measure subjective KPIs in order to avoid any possible discrepancies in interpreting the measurement of KPIs and provide objective evaluation results based on quantitative evidences (see appendix E).

As Figure 7 depicts the importance of relationship indicators, which are a foundation, underpin process and result indicators of P&A projects (Crane et al., 1999).

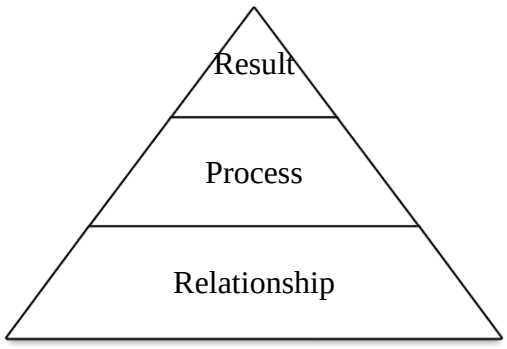

Figure 7 Partnering and Alliancing Triangle (source: Crane et al., 1999)

Crane et al., (1999) points out that as the distinction on the different types of indicators are made, the different "levels" of indicators of P&A should be addressed: relationship, project, and discipline. Alliance indicators track performance at the management level across multiple projects. Project indicators monitor the accomplishment of key criteria for a specific project. Discipline indicators apply to the impact of P&A at the lowest levels of a project (p. 41).

Lastly, Segil (2004) demonstrates that different elements and aspects need to be considered when developing and implementing KPIs of P&A such as different life cycle stages (project phases), characteristics of projects, organizational culture, and stakeholders in projects. In addition, the author adds that KPIs must be designed and modified so as to give an organization and its partners a clear understanding of "why P&A is still worth doing", while gathering the results in such a way that can give meaningful insights on P&A to those who are not actually involved in it.

3.5.6 Key Performance Indicators (KPIs) of Partnering and Alliancing (P&A)

In this section, a total number of 19 key performance indicators of partnering and alliancing, are illustrated from the literature review.

1) Quality

Chan and Chan (2004) illustrate that the assessment of quality is rather subjective. Quality is defined as a totality of features required by a product or service to satisfy a given need and to meet a purpose. To complement this subjective aspect of quality, for example, quality assurance (QA) and quality management (QM) have been introduced, and these are widely used in a global sense to certify and guarantee quality of deliverables such as ISO 9000 schemes. Crane et al. (1999) indicates that quality typically is measured by such as the amount of rework required. Cheung et al. (2003a) add that it is measured how well the work is completed in accordance with the design requirements.

2) Health and Safety

Jefferies et al. (2014) stress that it is important to provide a safe work place evidenced by zero incidents and injuries. Health and Safety can be measured by compiling safety statistics such as lost time incidents. Yeung et al. (2009b) add that it is measured by accident rate of a project, such as low accident rate, average, or accident rate. Ibrahim et al. (2013) highlight that health and safety performance can be improved through collaboration among an integrated team. For example, safety records are one of the factors that facilitate building such scenario; there would be a collective responsibility for health and safety implication during a whole-life of a project.

3) Effective communication

This refers to a level of effective cooperation, communication and teamwork at all levels (Yeung et al., 2009b). Ibrahim et al. (2013) illustrate that lack of communication in any project can be detrimental, particularly in a multidisciplinary construction project. The authors suggest having an open environment to improve communication, which encourages face-to-face relationships and close interactions between team members.

4) Cost

Chan and Chan (2004) indicate that cost can be measured at a degree where the general conditions promote the completion of a project within the estimated budget. Cost is not only confined to the tender sum, but also it is the overall cost that a project incurs from inception to completion, which includes any costs arising from variations, modification during the construction period and legal claims such as litigation and arbitration. Cost can be measured by the total cost of a project, such as within budget, on budget or over budge - how well the project adheres to the agreed budget (Cheung et al., 2003a; Crane et al., 1999; Yeung et al., 2009b). Jefferies et al. (2014) illustrate that cost also can be measured minimizing life cycle costs, for example, better the target program cost by 20 percent without adversely affecting quality and operational standards.

5) Time

Time can be measured by how well a project adheres to the planned/estimated schedule over a period of time (Cheung et al., 2003a; Crane et al., 1999). Yeung et al. (2009b) add that time refers to the variation of a project such as ahead of schedule, on schedule or behind schedule. Chan and Chan (2004) illustrate that time refers to the duration for completing a project and is related to the concept of effectiveness. It is scheduled to enable the building to be used by a data that is determined by the client's future plans. Effectiveness is a measure of how well a project was implemented or the degree to which targets of time and cost were met from the start-up phase to full production.

6) Trust and Respect

This refers to a level of trustfulness and respectfulness among different stakeholders (Yeung et al, 2009b). Ibrahim et al. (2013) depict that one of the fundamental differences between traditional contracting and relationship contracting is a requirement to trust the other team members. A lack of trust and commitment can deter the development of the integrated P&A team from happening.

7) Environment

Chan and Chan (2004) illustrate that an application of ISO 14000, the environmental Impact assessment (EIA) score and the total number of complaints received during the construction can be used as an indicator to reflect the environmental performance of a project. Yeung et al. (2009b) add that number of complaints received cause of environmental problems of a project. Jefferies et al. (2014) also indicate that this can be measured by minimizing the environmental impact during the delivery of works and operational phases.

8) Innovation and Improvement

This refers to a number of new initiatives for improvement introduced (e.g. construction techniques, procurement) in a project (Yeung et al., 2009b). Ibrahim et al. (2013) indicate that one of the core principles of collaboration is to stimulate a team's ability to generate innovative solutions and improvements in the construction process (e.g. introduction of new construction techniques).

9) Problem resolution process and workshop

This refers to whether a project uses a structured or unstructured approach towards implementing P&A (Yeung et al, 2009b). Just applying and implementing conflict and problem resolution is not a panacea to prevent and/or to solve all problems. The process of such resolution should be monitored and managed; how productive and effective it is to see if it brings intended results and there is more to improve (Aarseth et al., 2012; Chan et al., 2003).

10) Job and participants' satisfaction

Chan and Chan (2004) indicate that participants' satisfaction has been proposed as an important measure. Their level of satisfaction can be taken as an indicator of project success measured by the seven-point scale. A level to individual job satisfaction and career development opportunities also can be used as indicators (Yeung et al., 2009b).

11) Commitment from senior management

This refers to a level of senior management commitment to supporting P&A approaches in terms of their involvements and examples (Yeung et al., 2009b).

12) Schedule

This refers to meeting relevant license specifications in terms of sites, timeframes, performance and optimizing the program rollout rate (Jefferies et al., 2014).

13) Value and Profit

This refers to the profitability of a project, such as high profit, break even or serious loss (Yeung et al, 2009b). Chan and Chan (2004) regard the measure of value as evaluating the satisfaction of the owner's needs in a global sense. This includes the realization for the owner of quantifying produced, operational and maintenance costs and flexibility. The most common measure of financial achievement is net present value (NPV).

14) Client's satisfaction

This refers to a level of satisfaction for the client organization to participating a project (Yeung et al., 2009b). Jefferies et al., (2014) indicate that this can be measured by satisfying client's legislative and regulatory requirements.

15) Functionality

This refers to a fulfillment of intended functions at the end of the day. This can be measured by the degree of conformance to all technical performance specifications (Chan & Chan, 2004)

16) Harmonious and cooperative working relationships

This refers to developing harmonious working relationships among all project stakeholders at all levels. Building up long-term business relationships with other contracting parties involved in a project can be included (Yeung et al., 2009b).

17) Employee's attitude

This refers to the implementation of P&A approach in a project; how employees act on toward P&A approach whether negative or positive (Crane et al., 1999; Yeung et al., 2009b).

18) Litigation occurrence and magnitude

This refers to litigation (dispute) numbers and amounts of a project (Yeung et al., 2009b). This indicator can be related to litigation costs, project can be suspended due to the litigation,

19) Resource utilization and commitment

This refers to how input resources are converted into intended outputs i.e. deliverables. How resources are utilized effectively and efficiently while minimizing resource wastes. Richey et al. (2005) illustrate that resource commitment deals with how valuable resources are allocated or targeted to produce the most goods. (p. 234).

Table 4 16 KEs and 19 KPIs of P&A from the literature review (in construction projects)

No.	Rank	KEs	Count	Rank	KPIs	Count
1	1	Trust	11	1	Quality	8
2	2	Conflict and problem resolution	9	2	Health and safety	7
3	2	Effective communication	9	2	Effective communication	7
4	3	Commitment	8	3	Cost	6
5	3	Mutual goals and objectives	8	4	Time	5
6	3	Continuous evaluation and improvement	8	4	Trust and respect	5
7	4	Risk and reward sharing mechanism	8	5	Environment	4
8	4	Cooperation and collaboration	7	5	Innovation and improvement	4
9	5	Partnering and alliancing tools	7	5	Problem resolution process and workshop	4
10	6	Win-win scenario	6	6	Job and participants' satisfaction	3
11	6	Contractor selection	5	6	Commitment from senior management	3

12	7	Clear role and responsibility	5	7	Schedule	2
13	8	Effectiveness of management board	4	8	Value and profit	2
14	8	Early involvement and empowerment	4	8	Client’s satisfaction	2
15	8	Flexibility to change and change management	4	8	Functionality	2
16	8	No blame culture	4	8	Harmonious and cooperative working relationships	2
17	-	-	-	8	Employees’ attitude	2
18	-	-	-	8	Litigation occurrence and magnitude	2
19	-	-	-	8	Resource utilization and commitment	2

4 Results

A total number of 113 respondents yield from the questionnaire survey. The 5-point Liker scale (1=less important and 5=most important) is used to identify and evaluate the importance and ranking and to observe how the different survey respondents perceive the level of KEs and KPIs of P&A.

The respondents indicate that they are working in different types of organizations in upstream O&G construction projects; 11% are working in client, 16% are rig-owner/operator, 33% are main contractor, 30% are sub-contractors, 4% are suppliers and 6% indicate other (e.g. shipyards, quality, agency, lab).

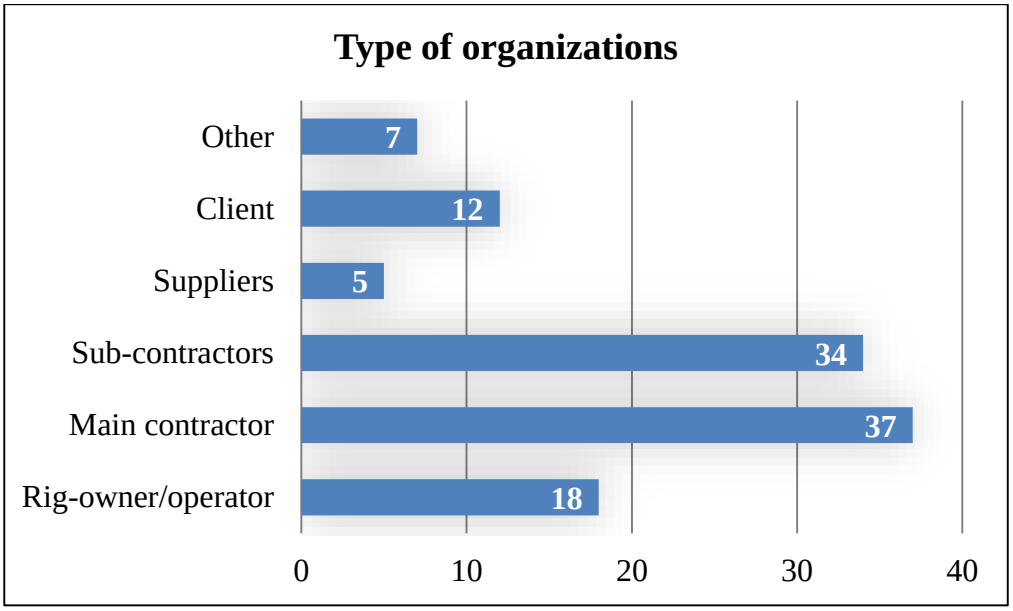

Figure 8 Type of organization in which respondents working

In terms of working experiences in upstream O&G construction projects, the respondents answer; 1 year or less are 4%, 1-3 years are 9%, 3-5 years are 13% and 10 years or more are 51%. The majority of 58 respondents have experiences working in upstream O&G construction projects for more than 10 years.

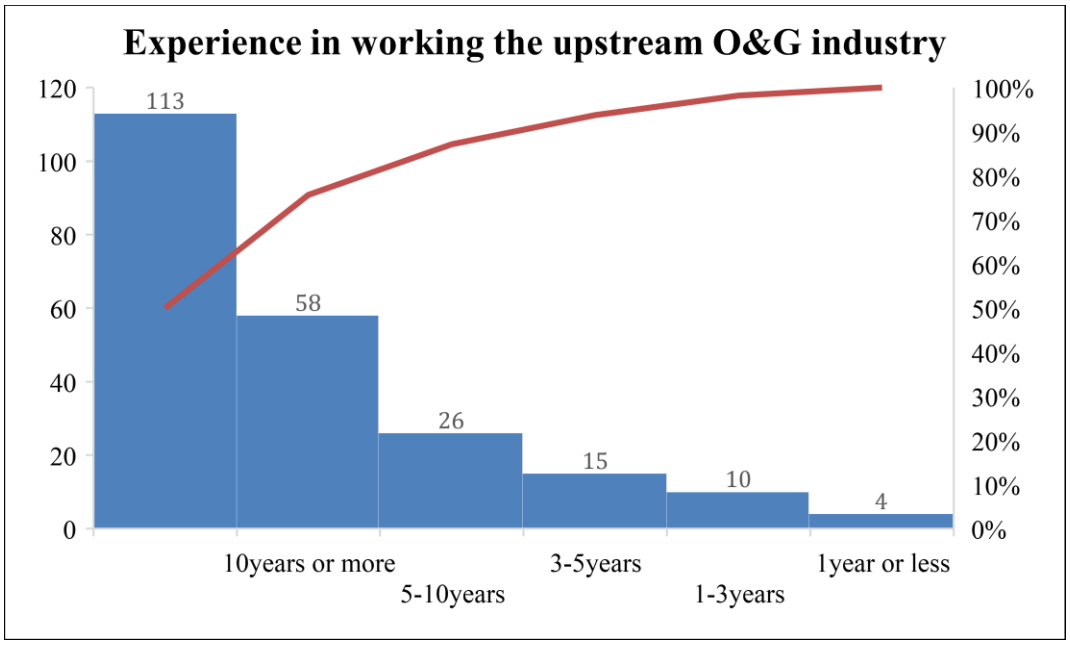

Figure 9 Experience in working upstream O&G construction projects of the respondents

In relation with working experiences in P&A projects, only 14 respondents indicate that they have experienced. The rest of 97 respondents reply that they did not have experience in working on P&A projects.

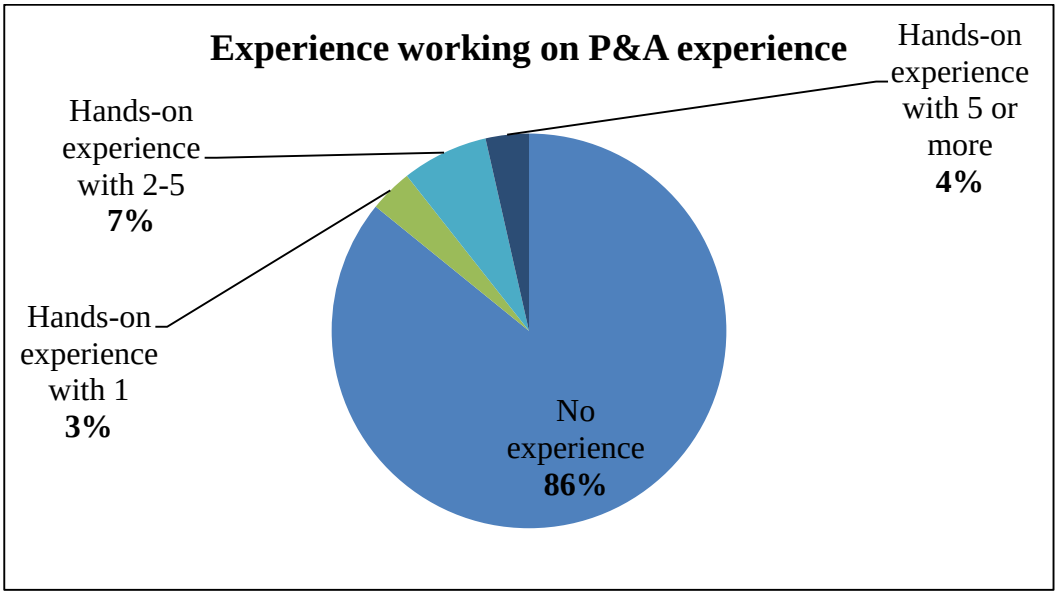

Figure 10 Experience working on P&A projects

More than the half of respondents (52% and 11%) shows very positive and positive opinions on P&A and PM. On one hand, 33% of the respondents express not interested. The rest of respondents (4%) represent negative and very negative opinions.

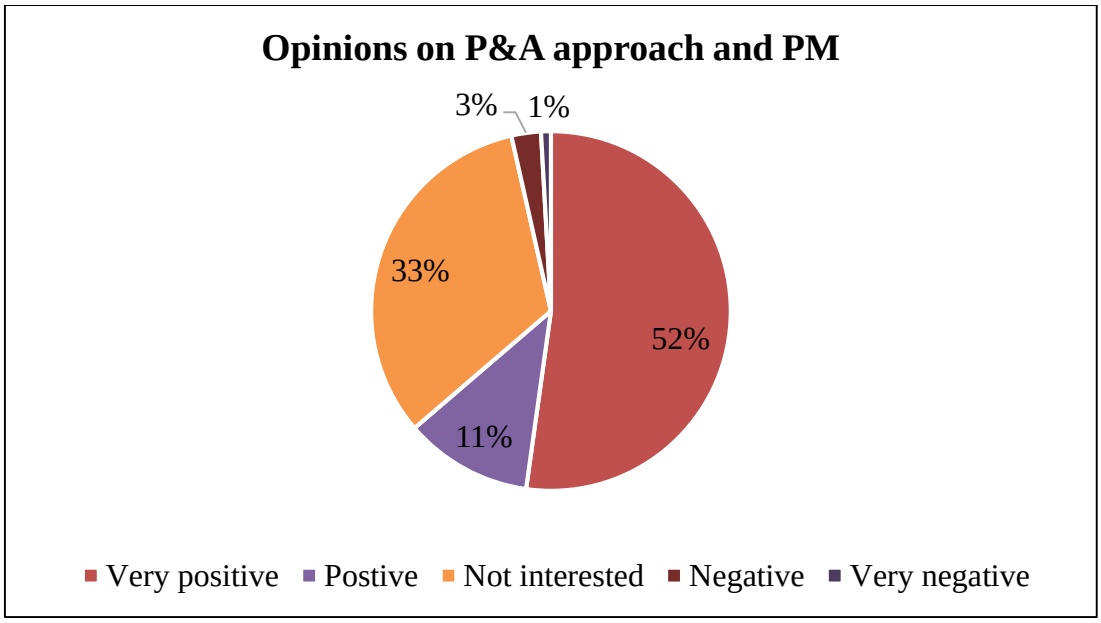

Figure 11 Opinions on P&A approach and PM of the respondents

4.1 Key Elements (KEs) of Partnering and Alliancing (P&A)

First, the questionnaire survey is analyzed based on all respondents by using the mean value method and Kendall's coefficient of concordance (W) (without any variations). The analysis of result identifies that the top fifty percent KEs of P&A in upstream O&G construction projects are (1) trust (2) effective communication (3) clear role and responsibility (4) cooperation and collaboration (5) mutual objectives and goals (6) risk and reward sharing mechanism (7) conflict and problem resolution and (8) continuous evaluation and improvement.

Table 5 The importance and ranking of KEs of P&A from the result analysis

No.	Key elements	Mean Value	Std. Deviation	Min.	Max.	Mean Rank	Rank
1	Trust	4.18	1.197	1.0	5.0	11.29	1
2	Commitment	3.55	1.086	1.0	5.0	8.50	9

3	Risk and reward sharing mechanism	3.84	1.107	1.0	5.0	9.48	6
4	Mutual objectives and goals	3.84	1.065	1.0	5.0	9.57	5
5	Partnering and alliancing tools	3.20	1.045	1.0	5.0	6.47	14
6	Conflict and problem resolution	3.77	1.035	1.0	5.0	9.23	7
7	Continuous evaluation and improvement	3.65	0.933	1.0	5.0	8.65	8
8	Effective communication	3.98	1.069	1.0	5.0	10.34	2
9	Clear role and responsibility	3.95	1.101	1.0	5.0	10.15	3
10	Cooperation and collaboration	3.87	1.031	1.0	5.0	9.83	4
11	Win-win scenario	3.54	1.061	1.0	5.0	8.12	10
12	Contractor selection	3.51	1.001	1.0	5.0	7.85	11
13	No-blame culture	3.19	1.059	1.0	5.0	6.46	15
14	Effectiveness of management board	2.93	1.116	1.0	5.0	5.35	16
15	Flexibility to change and change management	3.354	1.125	1.0	5.0	7.20	13
16	Early involvement and empowerment	3.425	1.042	1.0	5.0	7.49	12
	N	113					
	Kendall's W[a]	0.194					
	Chi-Square	284.989					
	df (degree of freedom)	15					
	Asymp. Sig.	0.000					

a. Kendall's Coefficient of Concordance

The result of reliability analysis is found out to be very high as the value of 0.945 regarding 16 KEs of P&A. This result represents the internal consistency of the KEs is very high.

Table 6 The reliability analysis result of KEs

	Reliability Statistics	**Scale Statistics**		
N of Items	Cronbach's Alpha	Mean	Variance	Std. Deviation
16	0.945	57.788	160.240	12.6586

Secondly, the survey is analyzed and ranked by the different type of organizations in which the respondents working to observe the different perceptions of the parties depending on the different type of organizations. Note that "suppliers" is included in "sub-contractors", because the number of respondents is too small to analyze, which will result in low reliability of the research result. In addition, "other" is excluded due to validity of the research result.

From the viewpoint of client, (1) trust, effective communication (3) conflict and problem resolution (4) cooperation and collaboration (5) risk and reward sharing mechanism (6) continuous evaluation and improvement, clear role and responsibility and (8) mutual objectives and goals are found out to be the top fifty percent KEs of P&A. From the rig-owner/operator's point of view, (1) trust (2) effective communication (3) cooperation and collaboration (4) clear role and responsibility (5) mutual objectives and goals (6) conflict and problem resolution (7) risk and reward sharing mechanism and (8) win-win scenario are identified as the top fifty percent KEs of P&A. From the main contractor's perspective, (1) clear role and responsibility (2) trust (3) risk and reward sharing mechanism (4) effective communication (5) conflict and problem resolution (6) mutual objectives and goals (7) cooperation and collaboration and (8) commitment are considered as the top fifty percent KEs of P&A. From the sub-contractors/suppliers' points, (1) trust (2) effective communication (3) cooperation and collaboration (4) mutual objectives and goals (5) clear role and responsibility (6) risk and reward sharing mechanism (7) conflict and problem resolution and (8) commitment are regarded as the top fifty percent KEs of P&A.

Table 7 The different ranking of KEs depending on the different type of organizations

No.	Key elements	Client	Rig owner/ operator	Main contractor	Sub-contractors/ suppliers

1	Trust	1	1	2	1
2	Commitment	12	10	8	8
3	Risk and reward sharing mechanism	5	7	3	6
4	Mutual objectives and goals	8	5	6	4
5	Partnering and alliancing tools	13	14	16	14
6	Conflict and problem resolution	3	6	5	7
7	Continuous evaluation and improvement	6	9	9	9
8	Effective communication	1	2	4	2
9	Clear role and responsibility	6	4	1	5
10	Cooperation and collaboration	4	3	7	3
11	Win-win scenario	11	8	10	11
12	Contractor selection	10	11	13	10
13	No-blame culture	9	15	14	15
14	Effectiveness of management board	16	16	15	16
15	Flexibility change and change management	14	12	12	13
16	Early involvement and empowerment	12	13	11	11
	N	12	18	37	39

	Kendall's W[a]	0.140	0.293	0.142	0.219
	Chi-Square	25.219	79.077	79.056	127.823
	Degree of freedom (df)	15	15	15	15
	Asymp. Sig.	0.047	0.000	0.000	0.000

a. Kendall's Coefficient of Concordance

Third, the survey is analyzed to see how P&A experience and No P&A experience affect the ranking of the KEs of P&A. Respondents, who have experiences in working on P&A projects, indicate following elements as the top fifty percent KEs of P&A: (1) trust (2) mutual objectives and goals (3) risk and reward sharing mechanism (4) effective communication (5) clear role and responsibility (6) commitment (7) conflict and problem resolution and (8) contractor selection. On the other hand, respondents, who did not have experiences in working on P&A projects, consider the top fifty percent KEs of P&A as follows: (1) trust (2) effective communication (3) clear role and responsibility (4) cooperation and collaboration (5) mutual objectives and goals (6) risk and reward sharing mechanism (7) conflict and problem resolution and (8) continuous evaluation and improvement.

Table 8 The different importance and ranking of KEs between P&A experience and No P&A experience

-	-	P&A experience		No P&A experience	
No.	Key elements	Mean Value	Rank	Mean Value	Rank
1	Trust	4.688	1	4.093	1
2	Commitment	4.250	6	3.433	10
3	Risk and reward sharing mechanism	4.563	3	3.722	6
4	Mutual objectives and goals	4.688	2	3.701	5
5	Partnering and alliancing tools	3.625	13	3.134	15
6	Conflict and problem resolution	4.375	7	3.670	7

7	Continuous evaluation and improvement	3.875	11	3.619	8
8	Effective communication	4.438	4	3.907	2
9	Clear role and responsibility	4.375	5	3.876	3
10	Cooperation and collaboration	4.188	9	3.814	4
11	Win-win scenario	3.813	12	3.495	9
12	Contractor selection	4.188	8	3.402	11
13	No-blame culture	3.250	16	3.186	14
14	Effectiveness of management board	3.625	15	2.814	16
15	Flexibility change and change management	3.563	14	3.320	12
16	Early involvement and empowerment	4.250	10	3.289	13
	N	16		97	
	Kendall's W[a]	0.344		0.160	
	Chi-Square	82.634		232.238	
	df	15		15	
	Asymp. Sig.	0.000		0.000	

a. Kendall's Coefficient of Concordance

4.2 Key Performance Indicators (KPIs) of Partnering and Alliancing (P&A)

The survey is analyzed based on all respondents without any variations. The analysis of result represents following PIs as the top fifty percent KPIs of P&A: (1) health and safety (2) quality (3) trust and respect (4) effective communication (5) client's satisfaction (6) cost (7) time (8) schedule and (9) harmonious and cooperative working relationships.

Table 9 The importance and ranking of KPIs of P&A from the result analysis

No.	KPIs	Mean Value	Std. Deviation	Min.	Max.	Mean Rank	Rank
1	Quality	4.04	1.072	1.0	5.0	12.82	2
2	Health and safety	4.18	1.120	1.0	5.0	13.61	1
3	Effective communication	3.83	1.043	1.0	5.0	11.42	4
4	Cost	3.77	1.110	1.0	5.0	11.05	6
5	Time	3.76	0.993	1.0	5.0	10.96	7
6	Trust and respect	3.88	1.016	1.0	5.0	11.76	3
7	Environment	3.58	0.942	1.0	5.0	9.70	10
8	Innovation and improvement	3.53	1.001	1.0	5.0	9.36	12
9	Problem resolution process and workshop	3.39	0.986	1.0	5.0	8.40	16
10	Job and participants' satisfaction	3.45	1.009	1.0	5.0	8.81	15
11	Commitment from senior management	3.22	1.155	1.0	5.0	7.54	18
12	Value and profit	3.52	0.974	1.0	5.0	9.60	11
13	Client's satisfaction	3.81	1.014	1.0	5.0	11.30	5
14	Functionality	3.33	0.977	1.0	5.0	8.04	17
15	Harmonious and cooperative working relationships	3.58	0.962	1.0	5.0	9.78	9
16	Employee's attitude	3.43	1.093	1.0	5.0	8.93	14
17	Resource utilization and commitment	3.46	1.078	1.0	5.0	9.20	13
18	Litigation occurrence and magnitude	3.23	1.000	1.0	5.0	7.40	19
19	Schedule	3.62	1.080	1.0	5.0	10.31	8

	N	113
	Kendall's W[a]	0.139
	Chi-Square	282.099
	df	18
	Asymp. Sig.	0.000

a. Kendall's Coefficient of Concordance

The result of reliability analysis is found out to be very high as the value of 0.963 regarding 19 KPIs of P&A. This result indicates the internal consistency of the KPIs is very high.

Table 10 The reliability analysis result of KPIs

-	**Reliability Statistics**	**Scale Statistics**		
N of Items	Cronbach's Alpha	Mean	Variance	Std. Deviation
19	0.963	68.628	232.557	15.2498

Second, the survey is analyzed and ranked by the different type of organizations in which the respondents working to observe the different perceptions of the parties depending on the different type of organizations. Again, note that "supplier" is included in "sub-contractors", because the number of respondents is too small to analyze, which will result in low reliability of the research result. In addition, "other" is excluded due to validity of the research result.

From the client's point of view, (1) quality (2) health and safety (3) client's satisfaction (4) harmonious and cooperative working relationship (5) effective communication (6) schedule (7) cost, functionality and (9) trust and respect are identified as the top fifty percent KPIs of P&A. From the rig-owner/operator's perspective, (1) health and safety (2) quality (3) client's satisfaction (4) trust and respect (5) schedule (6) cost (7) environment (8) time and (9) effective communication are considered as the top fifty percent KPIs of P&A. The viewpoint of main-contractor, (1) health and safety (2) quality (3) time (4) effective communication (5) cost (6) value and profit (7) trust and respect (8) schedule and (9) employee's attitude are

regarded as the top fifty percent KPIs of P&A. From the sub-contractors/suppliers' viewpoints, (1) health and safety (2) quality (3) trust and respect (4) client's satisfaction (5) effective communication (6) cost (7) time (8) environment and (9) innovation and improvement are found out to be the top fifty percent KPIs of P&A.

Table 11 The different ranking of KPIs depending on the different type of organizations

No.	KPIs	Client	Rig owner/ operator	Main contractor/	Sub-contractors/ supplier
1	Quality	1	2	2	2
2	Health and safety	2	1	1	1
3	Effective communication	5	9	4	5
4	Cost	7	6	5	6
5	Time	10	8	3	7
6	Trust and respect	9	4	7	3
7	Environment	14	7	12	8
8	Innovation and improvement	11	14	14	9
9	Problem resolution process and workshop	13	15	16	14
10	Job and participants' satisfaction	12	10	15	15
11	Commitment from senior management	19	17	17	18
12	Value and profit	17	12	6	13
13	Client's satisfaction	3	3	10	4
14	Functionality	7	19	18	17
15	Harmonious and cooperative working relationships	4	13	12	10

16	Employee's attitude	17	15	9	16
17	Resource utilization and commitment	16	11	11	12
18	Litigation occurrence and magnitude	15	17	19	19
19	Schedule	6	5	8	11
	N	12	18	37	39
	Kendall's W[a]	0.194	0.316	0.123	0.169
	Chi-Square	41.902	102.359	81.877	118.600
	df	18	18	18	18
	Asymp. Sig.	0.001	0.000	0.000	0.000

a. Kendall's Coefficient of Concordance

Third, the survey is analyzed to see how P&A experience and No P&A experience affects the ranking of the KPIs of P&A. Respondents, who have experiences in working on P&A projects, indicate following as the top fifty percent KPIs of P&A: (1) schedule (2) trust and respect (3) quality, health and safety (5) client's satisfaction (6) cost (7) environment (8) harmonious and cooperative working relationships and (9) job and participants' satisfaction, while, respondents, who did not have experiences in working on P&A projects, considers the top fifty percent KPIs of P&A as follows: (1) health and safety (2) quality (3) trust and respect (4) effective communication (5) client's satisfaction (6) cost (7) time (8) environment and (9) schedule.

Table 12 The different importance and ranking of KPIs between P&A experience and No P&A experience

-	-	P&A experience		No P&A experience	
No.	KPIs	Mean Value	Rank	Mean Value	Rank
1	Quality	4.188	3	4.021	2
2	Health and safety	3.875	10	4.227	1

3	Effective communication	4.188	3	3.773	4
4	Cost	4.125	6	3.711	6
5	Time	4.125	7	3.701	7
6	Trust and respect	4.313	2	3.814	3
7	Environment	3.500	19	3.598	8
8	Innovation and improvement	3.813	16	3.485	12
9	Problem resolution process and workshop	3.813	15	3.320	16
10	Job and participants' satisfaction	4.000	9	3.361	15
11	Commitment from senior management	3.750	18	3.134	18
12	Value and profit	3.875	13	3.464	11
13	Client’s satisfaction	4.125	5	3.763	5
14	Functionality	3.750	16	3.258	17
15	Harmonious and cooperative working relationships	4.000	8	3.505	10
16	Employee's attitude	3.875	14	3.361	14
17	Resource utilization and commitment	3.938	11	3.381	13
18	Litigation occurrence and magnitude	3.875	12	3.124	19
19	Schedule	4.375	1	3.495	9
	N	16		97	
	Kendall's W[a]	0.112		0.163	
	Chi-Square	32.308		284.286	
	df	18		18	

	Asymp. Sig.	0.020	0.000

a. Kendall's Coefficient of Concordance

4.3 Anonymous Interviews

This interview is designed to illustrate opinions on P&A and its PM regardless of working in P&A projects. In addition, it is to investigate chronical problems and any improvement should be made based on interviewees' experiences in the field of upstream O&G industry. A total number of 6 interviews are carried out. From the interview 1 to 3, the interviewees have experienced working in P&A projects, while the interviewees from the interview 4 to 6 do not have experiences working in P&A projects.

Interview 1

He illustrates opinions on risk and reward sharing mechanism and performance measurement based on his experience. A project, in which he worked, faced an economic crisis (i.e. low oil price). The management board of project hold an online meeting, announced that they would not fire any members in the project due to the economic crisis, instead they decide to share the pain by the reduction of all employees' wages based on their performances. The management board asked employees' opinions on the decision made. He and his colleagues felt that they were involved, and the reduction of wage based on PM was reasonable and understandable. Furthermore, he stresses that since upstream O&G construction projects could be considered as a type of virtual organization while evolving a number of participants regardless of geographic locations (both nationally and internationally). Therefore, it requires a better integration of different parties (e.g. project managers, construction managers, quality managers, commissioning, etc.) to perform a P&A project.

Interview 2

I think the priority of P&A is recognizing the advantages of each party and creating synergy effects through the strong bond. And then the final goal is an approachment, which can eliminate potential risk to the current project and achieving stable outcomes. In addition, the most important thing here is that mutual trust and recognition of horizontal relationships should work as important elements. However, the establishment of bond between research institutions, which have expert knowledge, and individual/enterprise that have special

technique needs to be improved, because now in Korea P&A system is emphasized only in manufacturing industries.

Interview 3

In order to achieve the objectives of a project, a thorough feasibility study of P&A should be carried out so that trial and error should be preventable in advance during the execution of the project. Most consortium projects are based on a win-win philosophy, but it is inevitable to compete excessively in virtue of one's own interest. Additionally, we are not trying to make good profits rather trying to minimize risk. Making profits is important, but avoiding deficit and minimizing risk could be even more important. In addition, overcoming egoism and opportunism behaviors in projects, which need to be improved, is more important than a process improvement.

Interview 4

She advocates applying "relationship-based contracting" in projects, while explaining how inefficient a project under a traditional contracting method can be. She experienced time-consuming communication between different organizations (e.g. rig-owner/operator and main-contractor and sub-contractors) even though they were working in the same location (but, in different offices). People tended to be suspicious, did not trust each other and look after one's own profits. In addition, she points out the role of a project director and manager (e.g. leadership skills), which is important and affects a working environment in projects.

Interview 5

He points out chronic problems of the traditional contracting methods, for instance, "the power trip" of clients. Clients want their contractors to finish projects fast at a low price, but time-pressed situation cannot guarantee a good quality. It takes time and effort to get a desirable outcome; haste causes negligent accidents and comes at the expense of quality. In addition, the process is too pressed for time for personnel to dedicate themselves to self-development. Moreover, the client's power trip gets shifted onto lower levels of organization, which causes many problems. There are many cases of the power trip, which make it difficult to survive as a partner, for example, delay of inspection, reducing unit price, etc.

Interview 6

There is a famous proverb in the Korean shipyards, which everybody knows, is said; “an action taken by several persons is better than several actions taken by a person”. I wish a culture and process of “going together” will be established in near future and this kind of culture will be developed and finally it could help national development. Moreover, increasing understanding of P&A is necessary for those who have just been exposed to the concepts of P&A, for example, ongoing workshops and periodical publications of P&A. The establishment of this kind of system (relationship-based contracting and its performance measurement) can create more employments and provide a safe working environment. I wish a better upstream O&G industry could be settled, by collecting extensive opinions from all levels of an organization.

5 Discussion

In this chapter, the discussions on the defined research questions and the interviews are elaborated. In addition, this thesis tries to illustrate discussions on the different perception of the parties depending on the different type of organizations (client, rig-owner/operator, main-contractor and sub-contractors/suppliers) in relation to the different importance and rank of the KEs and KPIs of P&A and also it is to observe how P&A experience and No P&A experience affect the important and rank of the KEs and KPIs of P&A.

5.1 What are the KEs and KPIs of P&A in upstream O&G construction projects?

The analysis of result from the questionnaire survey identifies the KEs and KPIs of P&A in upstream O&G construction projects. The top fifty percent KEs are (1) trust (2) effective communication (3) clear role and responsibility (4) cooperation and collaboration (5) mutual objectives and goals (6) risk and reward sharing mechanism (7) conflict and problem resolution (8) continuous evaluation and improvement and (9) commitment. The top fifty percent KPIs are (1) health and safety (2) quality (3) trust and respect (4) effective communication (5) client's satisfaction (6) cost (7) time (8) schedule and (9) harmonious and cooperative working relationships (Table 13).

"Trust" is identified as the most important KEs of P&A. This result is in accordance with Chan et al. (2004) and Cheung et al. (2003b) arguments. Trust is the most pivotal attitudinal factor, which underpins P&A. This eliminates a probability of opportunism behavior in a project, make each party to believe that other parties will fulfill their work and all parties involved in a project start living up to each other's expectations.

While "cost, time and quality" are considered as the most important indicators/dimensions in a traditional view on projects, the identified KPIs from the result represents that there should be more cares and concerns in terms of human factors in P&A projects in addition to cost, time and quality (i.e. result and process indicators). This result can be supported by Crane et al. (1999), who argue that since P&A projects contain behavioral aspects, it is imperative to develop and measure relationships in order to evaluate success as well as diagnose health (i.e. health check) of the relationships. Furthermore, the result can be interpreted that project participants want a safe place to work where they can "trust and respect" each other so that

working relationships became harmonious and cooperative; this may increase a productivity of work.

Additionally, it is notable that quality, which is ranked as second, is still considered a more important indicator than cost and time. One the other hand, cost and time are ranked as sixth and seventh, which can imply human factors i.e. people in projects should be more concerned and other approaches and/or methods should be utilized to promote cost and time indicators in P&A projects. These results can be related to the arguments of Aarseth (2012), who points out the importance of managing organizational challenges to achieve success and also Chan and Chan (2004), who suggest the consolidate framework to measure success of projects that includes commercial profit and value, environmental performance, user expectation and satisfaction, and participants' satisfaction in addition to cost, time and quality.

"Effective communication" is found out to be important in both the KEs and KPIs of P&A (second and fourth). This means that effective communication is the critical factor in P&A projects as both the KEs and KPIs. Interviewees and authors emphasize the importance of effective communication, because if communication is blocked or limited, there will be a climate of mistrust, and moreover, the egoism and opportunism behaviors will happen in projects (Cheung et al., 2003b; Walker et al., 2003b). After all, it is not a development or evolution of managing projects by means of applying P&A approach, rather it becomes a regression to the traditional systems, which resulting in counterproductive effects (Andersen, 2015).

In terms of Kendall's Coefficient of Concordance (W) between the KEs and KIs of P&A, the KEs that is 0.194, a closer value to 1, has higher consistency in ranking. All P-values (P) are lower than the level of significance 0.05, it can be concluded that the way of deciding ranking of 113 assessors (respondents) are consistent regarding 16 KEs and 19 KPIs of P&A.

Table 13 The KEs and KPIs from the findings (in upstream O&G construction projects)

Rank	KEs of P&A	KPIs of P&A
1	Trust	Health and safety
2	Effective communication	Quality
3	Clear role and responsibility	Trust and respect

4	Cooperation and collaboration	Effective communication
5	Mutual objectives and goals	Client’s satisfaction
6	Risk and reward sharing mechanism	Cost
7	Conflict and problem resolution	Time
8	Continuous evaluation and improvement.	Schedule
9	Commitment	Harmonious and cooperative working relationships
N	113	113
W[a]	0.194	0.139
Chi.	284.989	282.099
df	15	18
Asy.	0.000	0.000

a. Kendall's Coefficient of Concordance

The results from reliability analysis indicate that the both KEs and KPIs have very high reliability as 0.945 and 0.965 respectively. These results represent that the internal consistency of the both KEs and KPIs are very high.

Table 14 The reliability analysis results of KEs and KPIs of P&A

-	**Reliability Statistics**	-	**Reliability Statistics**
N of KEs	Cronbach's Alpha	N of KPIs	Cronbach's Alpha
16	0.945	19	0.963

5.1.1 How the perceptions are different depending on the type of organizations?

In common with the result above, “trust” and “effective communication” are identified as the important KEs of P&A irrespective of the different type of organizations. However, the remarkable differences are that main-contractor considers “clear role and responsibility” and “risk and reward sharing mechanism” as more important KEs in comparison with other type of organizations. In addition, apart from client, rig-owner/operator chooses “win-win scenario”, main-contactor and sub-contractors/suppliers deems “commitment” as the KEs of P&A.

Kendall's Coefficient of Concordances (W) are analyzed 0.140, 0.293, 0.142 and 0.219 respectively. Rig-owner/operator, which is 0.293, a closer value to 1 among the different type of organizations, has higher consistency in ranking. All P-values (P) are lower than the level of significance 0.05, it can be considered that the way of deciding ranking of the different type of organizations are consistent regarding 16 KEs of P&A.

Table 15 The different ranking of KEs depending on the different type of organizations

Rank	Client	Rig-owner/ operator	Main contractor	Sub-contractors/ Suppliers
1	Trust, Effective communication	Trust	Clear role and responsibility	Trust
2		Effective communication	Trust	Effective communication
3	Conflict and problem resolution	Cooperation and collaboration	Risk and reward sharing mechanism	Cooperation and collaboration
4	Cooperation and collaboration	Clear role and responsibility	Effective communication	Mutual objectives and goals
5	Risk and reward sharing mechanism	Mutual objectives and goals	Conflict and problem resolution	Clear role and responsibility
6	Continuous	Conflict and	Mutual objectives	Risk and reward

	evaluation and improvement,	problem resolution	and goals	sharing mechanism
7	Clear role and responsibility	Risk and reward sharing mechanism	Cooperation and collaboration	Conflict and problem resolution
8	Mutual objectives and goals	Win-win scenario	Commitment	Commitment
N	12	18	37	39
W[a]	0.140	0.293	0.142	0.219
Chi.	25.219	79.077	79.056	127.823
df	15	15	15	15
Asy.	0.047	0.000	0.000	0.000

a. Kendall's Coefficient of Concordance

"Health and safety" and "quality" are identified as the most important KPIs of P&A. However, unlike other type of organizations, client puts great stress on "quality". In addition to that, client determines the low ranking of "trust and respect" (ninth), while "trust and respect" is deemed as relatively high (the ranking) in other type of organizations (fourth, seventh and third respectively).

Kendall's Coefficient of Concordance (W) are found out to be 0.194, 0.316, 0.123 and 0.169 respectively. Again, rig-owner/operator, which is 0.316, a closest value to 1, has higher consistency in ranking. All P-values (P) are lower than the level of significance 0.05, it can be concluded that the way of deciding ranking of the different type of organizations are consistent regarding 19 KPIs of P&A.

Table 16 The different ranking of KPIs depending on the different type of organizations

Rank	Client	Rig-owner/ operator	Main-contractor	Sub-contractors/ suppliers

1	Quality	Health and safety	Health and safety	Health and safety
2	Health and safety	Quality	Quality	Quality
3	Client's satisfaction	Client's satisfaction	Time	Trust and respect
4	Harmonious and cooperative working relationships	Trust and respect	Effective communication	Client's satisfaction
5	Effective communication	Schedule	Cost	Effective communication
6	Schedule	Cost	Value and profit	Cost
7	Cost	Environment	Trust and respect	Time
8	Functionality	Time	Schedule	Environment
9	Trust and respect	Effective communication	Employee's attitude	Innovation and improvement
N	12	18	37	39
W[a]	0.194	0.316	0.123	0.169
Chi.	41.902	102.359	81.877	118.600
df	18	18	18	18
Asy.	0.001	0.000	0.000	0.000

a. Kendall's Coefficient of Concordance

Put in all, these results are (both the KEs and KPIs of P&A) worthwhile to see the different perceptions of the parties depending on the difference type of organizations in order to understand each other better in terms of their positions and perspectives. Moreover, it is invaluable to analyze and compare the result based on the different type of organizations, because as authors argue that in order to achieve the objective of P&A projects, the

arrangement of appropriate strategies for lower level of organizations and the inclusion of lower level of organizations' stances should be taken into account (Aarseth et al., 2012; Alderman & Ivory, 2007). The result from both the KEs and KPIs of P&A in relation with Kendall's Coefficient of Concordance (*W*), rig-owner/operator has the highest consistency in ranking among the different type of organizations. All P-values (*P*) are lower than the level of significance 0.05, it can be concluded that the way of deciding ranking of the different type of organizations are consistent regarding both the KEs and KPIs of P&A.

5.1.2 How the importance and ranking are different between P&A experience and No P&A experience?

"Trust" is identified as the most important KEs of P&A regardless of working experiences in P&A projects. The ranking of other rest elements is slightly different, but it can be considered that the elements, which everybody thinks important, are identical. "Commitment" and "contractor selection" are regarded as the KEs of P&A considering people who have experiences working in P&A projects, on the other hand, "cooperation and collaboration" and "continuous evaluation and improvement" are found to be the KEs of P&A according to people who do not experiences working in P&A projects. It is ambiguous to compare the importance between these four KEs, because many authors insist that all these four KEs of P&A are essential to achieve success of P&A projects (Aaresth et al., 2012; Black et al., 2000; Chan et al., 2004; Crowley et al., 1999; Lloyd-walker et al., 2014; Walker & Hampson, 2008; Walker et al., 2002). Thus, it can be regarded as the opinions on what the most important KEs are having consistencies in relation with the KEs of P&A.

A comparison of Kendall's Coefficient of Concordance (*W*) between the P&A experience group and the No P&A experience group, the P&A experience group, which is 0.334, a closer value to 1, has higher consistency in ranking of the KEs of P&A. All P-values (*P*) are lower than the level of significance 0.05, it can be considered that the way of deciding ranking of two different groups are consistent regarding 16 KEs of P&A.

Table 17 The different ranking of KEs between P&A experience group and No P&A experience group

Rank	**P&A experience group**	**No P&A experience group**

1	Trust	Trust
2	Mutual objectives and goals	Effective communication
3	Risk and reward sharing mechanism	Clear role and responsibility
4	Effective communication	Cooperation and collaboration
5	Clear role and responsibility	Mutual objectives and goals
6	Commitment	Risk and reward sharing mechanism
7	Conflict and problem resolution	Conflict and problem resolution
8	Contractor selection	Continuous evaluation and improvement
N	16	97
W[a]	0.344	0.160
Chi.	82.634	232.238
df	15	15
Asy.	0.000	0.000

a. Kendall's Coefficient of Concordance

"Trust and respect" and "quality" and "health and safety" are deemed as the important KPIs of P&A irrespective of working experiences in P&A projects. Their rankings are slightly different, but the important KPIs are considerably identical. People who have working experiences in P&A projects consider "job and participants' satisfaction" as the KPIs of P&A. This result can be related to the arguments, which are mentioned by authors, people and human aspects in P&A projects should be considered when choosing KPIs in addition to cost, time and quality (Aaresth, 2012; Aaresth et at., 2012; Chan & Chan; 2004; Cheung et al., 2003b). It is an intriguing fact that "schedule" is ranked as first in the P&A experience group, on the other hand, it is raked as ninth in the No P&A experience group. In addition to that, "harmonious and cooperative working relationships" is regarded as the KPIs in P&A

experience group, while “time” is identified as important the KPIs of P&A in the No P&A experience group.

Table 18 The different ranking of KPIs between P&A experience group and No P&A experience group

Rank	**P&A experience group**	**No P&A experience group**
1	Schedule	Health and safety
2	Trust and respect	Quality
3	Quality	Trust and respect
3	Health and safety	Effective communication
5	Client’s satisfaction	Client’s satisfaction
6	Cost	Cost
7	Environment	Time
8	Harmonious and cooperative working relationships	Environment
9	Job and participants’ satisfaction	Schedule
N	16	97
W[a]	0.112	0.163
Chi.	32.308	284.486
df	18	18
Asy.	0.020	0.000

a. Kendall's Coefficient of Concordance

To sum up, even if the KPIs, which the P&A experience group chooses, are rather assume a close aspects of the principles of P&A (e.g. trust and respect, harmonious and cooperative working relationships, job and participants’ satisfaction), the ones which the No P&A

experience group selects, tend the existing KPIs (e.g. time). Kendall's Coefficient of Concordance (W) between the P&A experience group and the No P&A experience group in relation to KPIs, on the contrary to the value of W of the KEs (0.344), the No P&A experience group, which is 0.163, a closer value to 1, has higher consistency in ranking. All P-values (P) are lower than the level of significance 0.05, it can be considered that the way of deciding ranking of two different groups are consistent regarding both 16 KEs and 19 KPIs of P&A.

5.2 What are the similarities and differences between the literature review and the findings?

In this section, the discussion on the second research question are elaborated; the similarities and differences between the literature review from construction projects and the findings from upstream O&G construction projects in terms of the KEs and KPIs of P&A.

5.2.1 The similarities and differences of KEs

The similarities between the literature review and the findings in relation to the KEs of P&A, "trust" and "effective communication" are found out to be the most important KEs of P&A in both construction and upstream O&G construction projects (among the top three). In addition, "risk and reward sharing mechanism", "cooperation and collaboration" and "continuous evaluation and improvement" are considered as the KEs of P&A regardless of different industries. These results can be interpreted that "trust", "effective communication", "risk and reward sharing mechanism", "cooperation and collaboration" and "continuous evaluation and improvement" are defining features of P&A projects irrespective of different industries.

There are noticeable differences between the literature review and the finding, "clear role and responsibility" and "mutual objectives and goals" are identified as the KEs of P&A from the findings in upstream O&G construction projects, while "commitment" and "partnering and alliancing tools" are listed as the KEs of P&A from literature review in construction projects. These differences can imply that even though both projects share common characteristics, certain elements of P&A can be and should be difference in practices. This result can be related to the arguments of Beger (1997) and Jones (2012). The authors argue

that how transferring concepts from one cultural and organizational context to another turn out to be (more or less) failures. In this sense, benchmarking can be a useful tool to transfer experiences and best practices successfully (Andersen, 2007, 2015; Bhutta & Huq, 1999; O'Dell & Grayson, 1999). Alderman and Ivory (2007) and Bresnen (2007) also argue that it is essential to understand how things (e.g. plans) can turn out to be wrong or unintended due to a contingency nature of P&A projects. In this regard, an interviewee and Jefferies et al. (2014) emphasize the importance of carrying out ongoing study and research so that trial and error should be preventable in advance during the execution of the projects in order to achieve the objectives of P&A projects.

Table 19 The KEs of P&A from the literature review and the findings

KEs in construction projects		KEs in upstream O&G construction projects	
Rank	**The literature review**	Rank	**The findings (all respondents)**
1	Trust	1	Trust
2	Conflict and problem resolution	2	Effective communication
2	Effective communication	3	Clear role and responsibility
4	Commitment	4	Cooperation and collaboration
4	Continuous evaluation and improvement	5	Mutual objectives and goals
4	Risk and reward sharing mechanism	6	Risk and reward sharing mechanism
7	Cooperation and collaboration	7	Conflict and problem resolution
7	Partnering and alliancing tools	8	Continuous evaluation and improvement

5.2.2 The similarities and differences of KPIs

The similarities between the literature review and findings in relation with the KPIs of P&A are identified as "health and safety", "quality" and additionally "effective communication".

This result represents that a safe and pleasant working environment should be guaranteed for all project participants in projects regardless of industries, which can help employees to produce better quality of work and outcomes through effective communication. These results can be related to Jefferies et al. (2014), who stress the importance of providing a safe work place evidenced by zero incidents and injuries and Ibrahim et al. (2013), who point out that lack of communication can be detrimental in any projects, particularly in a multidisciplinary project.

The differences between the literature review and finding are that "environment", "innovation and improvement" and "problem resolution process and workshop" are listed as the KPIs in construction projects from the literature review, while "client's satisfaction", "schedule" and "harmonious and cooperative working relationships" are identified as the KPIs of P&A in upstream O&G construction projects from the findings. It is an interesting fact that "client's satisfaction" is identified as the KPI of P&A in upstream O&G construction projects. A reason for this result can be assumed that unlike construction projects, upstream O&G construction projects are not directly linked to end-users (i.e. customers), rather close to clients; downstream O&G projects are more close to end-users.

Another remarkable difference is that in upstream O&G construction projects, "trust and respect" is ranked higher (third) compared to construction projects (fifth). In addition to that, "harmonious and cooperative working relationships" is appeared as the important KPI of P&A in upstream O&G construction projects. This result can indicate that upstream O&G construction projects are more characterized by relationships and behavioral aspects then construction projects, and thus, managers and management in upstream O&G construction projects should pay closer attention to managing and measuring these aspects: "trust and respect" and "harmonious and cooperative working relationships". The reason is that lack of trust and lack of commitment to fostering favorable working relationships can deter the development of an integrated P&A team from happening (Ibrahim et al., 2013). Also an interviewee points out the necessity of better integration of different parties (e.g. project managers, construction managers, quality managers, commissioning, etc.) to perform better P&A projects.

Table 20 The KPIs of P&A from the literature review and the findings

KPIs in construction projects	KPIs in upstream O&G construction projects

Rank	**The literature review**	Rank	**The findings (all respondents)**
1	Quality	1	Health and safety
2	Health and safety	2	Quality
2	Effective communication	3	Trust and respect
4	Cost	4	Effective communication
5	Time	5	Client's satisfaction
5	Trust and respect	6	Cost
6	Environment	7	Time
6	Innovation and improvement	8	Schedule
6	Problem resolution process and workshop	9	Harmonious and cooperative working relationships

5.3 Interviews

In general, the interview shows the positive feedback on P&A approach and its performance measurement. Also it is said that the more active researches should be carried out before an application of P&A. For example, the establishment of a better integration of P&A team, a feasibility study of P&A prior to its application and/or implementation while involving all levels of organizations (from top to bottom) and increasing understanding of the concepts of P&A (e.g. what is P&A, what is it for and why worth of doing it?) for employees who have not been exposed to P&A. The reason can be that if there is not enough understanding, employees in lower levels of organizations might feel that there are another burden and/or extra work they have to deal with, then it is clear that expecting more active participations is not easy. These agreements can be supported by many authors, who argue that it is important to increase understanding of the P&A concepts and its implementation (Clay et al., 2004; Farrell et al., 1996; Eriksson, 2010). In addition, Bresnen and Marshall (2002) also emphasize that it is important to be aware of the strengths as well as the limitations of P&A. Jefferies et

al. (2014) highlight that ongoing research (e.g. identifying CSFs and KPIs) into P&A should be carried out in order to ensure the sustainable development of P&A for all project stakeholders. Furthermore, P&A approach cannot improve performance of projects by itself; there should be recognition and active participations from both senior management and project managers (Chan et al., 2003; Suprapto et al., 2015).

An interviewee illustrates that the most consortium projects are based on a win-win philosophy, however, unfortunately parties are busy to look after their own profits, in turn, the win-win philosophy becomes and remains as "buying-in or mere puff". Authors have emphasized this issue as one of the significant problem of P&A that need to be prevented and improved (Alderman & Ivory, 2007; Bresnen, 2007; Cheung et al., 2003a). In addition, "the power trip" of clients, which is criticized by several interviewees, hampers better quality of work in projects, and moreover, this power trip gets shifted onto lower levels of organizations, which causes many problems. These chronical problems need to be fixed by starting trying to understand others' positions and also understanding a win-win situation by means of utilizing risk and reward sharing mechanism. For instance, a client uses a contractor's competence to optimize a project in the client's sense and the contractor, in turn, achieve a bonus by bringing in good ideas and/or better performance (Spang & Riemann, 2014).

The leadership skill of a project director and manager is emphasized that affects a working environment in projects. In this regards, Walker et al. (2013b) recommend that authentic leadership as an important behavioral trait in which leadership action is aligned with rhetoric and is consistent with liberating team members to maximize their contribution and a best-for-project attitude. Leadership may be officially vested in the P&A manager, but in reality it is distributed, because individual project team members take the initiative when and it is required based on their expertise, contribution and input into best-for-project decision and action outcomes. Aarseth (2012) suggest selecting managers and staff who have high RQ (relationship intelligence), along with IQ (intelligent quotient), EQ (emotional intelligence) and CQ (cultural intelligence) in global/international project setting.

The egoism and opportunism behaviors in projects are mentioned that deter any projects from achieving desired outcomes. An interviewee illustrates that these kinds of behaviors should be diminished, cooperation and collaboration of all project participants should be encouraged for a better culture and process in the upstream O&G industry. In this regard,

authors elaborate that trust can play an important role to get rid of these behaviors. Of course, it will take time to build and earn trust among parties, however, once trust takes a place, it will result in the performance exceeding expectations stimulating the synergy effects (Chan et al., 2004; Cheung et al., 2003b; Lolyd-walker et al., 2014; Walker et al., 2013b). In this context, interviewees highlight an establishment of cooperative and collaborative culture i.e. "going together" in projects. This argument aligns with Walker et al. (2013b), who argue that it is crucial to develop a collaborative culture so that "socially oriented trust" may blossom in P&A relationships that are opposed to adversarial relationships and "calculative trust". The authors stress that encouraging and building a culture of openness and willingness to share pain/gain and knowledge/lessons learned, which can facilitate "no-blame culture" where innovation in P&A projects can evolve. In addition, Aarseth (2012) stresses that it is critical to increase understanding of cooperative power of P&A approach to deal with organizational challenges. To do so, the author recommends having a holistic view of projects and its surroundings: both internal and external, which give project management various and wide perspectives. Ingirige and Sexton (2006) also suggest taking a holistic view in a way to manage P&A projects among senior management and project managers, by pointing out the value of long-term oriented collaboration and benefits of balancing P&A tasks and activities.

6 Conclusion

The purpose of this thesis to investigate the KEs and KPIs of P&A that can be applied from construction projects to upstream O&G construction projects for benchmarking. To do so, two research questions are defined and the comprehensive literature review is done to develop the questionnaire survey that is a basis for collecting the empirical data. SPSS is used to carry out for statistical analysis of the data. The mean value method and Kendall's coefficient of concordance (W) are used to determine and observe the different perceptions and the consistencies of ranking depending on different type of organizations and also to see how the importance and ranking of the KEs and KPIs of P&A differ between people who have working experiences in P&A projects and who does not have (i.e. P&A experience group and No P&A experience group). In addition, reliability analysis is carried out to evaluate the internal consistency of the measured KEs and KPIs based on the findings.

The analysis of empirical data reveals that the top fifty percent KEs are (1) trust (2) effective communication (3) clear role and responsibility (4) cooperation and collaboration (5) mutual objectives and goals (6) risk and reward sharing mechanism (7) conflict and problem resolution and (8) continuous evaluation and improvement. The identified top fifty percent KPIs are (1) health and safety (2) quality (3) trust and respect (4) effective communication (5) client's satisfaction (6) cost (7) time (8) schedule and (9) harmonious and cooperative working relationships. When compare the consistency in ranking between the KEs and KPIs, the KEs has higher consistency in ranking. The result from reliability analysis indicates that both the KEs and KPIs have very high reliability as 0.945 and 0.965 respectively. These results represent that the internal consistency of the KEs and KPIs are very high.

In relation with the perceptions of the KEs and KPIs of P&A depending on the different types of organizations (client, rig-owner/operator, main-contractor, and sub-contractors/suppliers), "trust" and "effective communication" are identified as the important KEs of P&A irrespective of the different type of organizations. Rig-owner/operator chooses "win-win scenario", main-contactor and sub-contractors/suppliers deems "commitment" as the KEs of P&A, while client does not consider these kinds of elements as the KEs. The remarkable differences are that main-contractor considers "clear role and responsibility" and "risk and reward sharing mechanism" as more important KEs in comparison with other type of organizations. "Health and safety" and "quality" are identified as the most important KPIs

of P&A. However, apart from other type of organizations, client puts great emphasis on "quality". In addition to that, client determines the low ranking of "trust and respect" (ninth), on the other hand, in other type of organizations, "trust and respect" is regarded as the high rankings relatively (fourth, seventh and third respectively). In terms of Kendall's Coefficient of Concordance (W), the result from both the KEs and KPIs of P&A, the consistency in ranking of rig-owner/operator has the highest among the different type of organizations. All P-values (P) are lower than the level of significance 0.05, it can be concluded that the way of deciding ranking of the different type of organizations are consistent regarding 16 KEs and 19 KPIs. It is worthwhile to analyze and compare the result based on the different type of organizations, because the result shows how the different parties have difference priorities and interests upon undertaking projects. Moreover, this result can be utilized to understand each other better in terms of different positions and perspectives.

In relation to the different importance and ranking of the KEs and KPIs of P&A between the P&A experience group and the No P&A experience group, "trust" is identified as the most important KEs regardless of working experiences. In addition, the ranking of other rest KEs are slightly different, but it can be considered that the KEs, which two different groups think important, are identical. "Trust and respect" and "quality" and "health and safety" are deemed as the important KPIs irrespective of working experiences. Their rankings are slightly different, but the important KPIs are considerably identical. In general, the KPIs, which the P&A experience group chooses, are rather assume close aspects of the principles of P&A, the ones which the No P&A experience group selects, tend the existing KPIs. In relation to Kendall's Coefficient of Concordance (W) of the KPIs between the P&A experience group and No P&A experience group, the P&A experience group, which is 0.344, a closer value to 1, has higher consistency in ranking of the KEs. On the contrary, the No P&A experience group, which is 0.163, a closer value to 1, has higher consistency in ranking of the KPIs. All P-values (P) of the KEs and KPIs are lower than the level of significance 0.05, it can be considered that the way of deciding ranking of two different groups are consistent regarding 16 KEs and 19 KPIs.

The similarities between the literature review and the findings of the KEs of P&A are identified as "trust", "effective communication", "risk and reward sharing mechanism", "cooperation and collaboration" and "continuous evaluation and improvement". These results of KEs can be regarded as defining features of P&A projects irrespective of industries. The

notable differences indicate that even though both projects share common characteristics, certain elements of P&A can be and should be difference in practices. The similarities between the literature review and the findings in relation to the KPIs of P&A are listed as “health and safety”, “quality” and additionally “effective communication”. On the other hand, it is an interesting fact that “client’s satisfaction” is identified as the KPI from the finding in upstream O&G construction projects. The remarkable difference is that “harmonious and cooperative working relationships” is appeared as the KPI of P&A from the findings, and moreover, “trust and respect” is ranked higher compared to construction projects. These results can be interpreted that upstream O&G construction projects are more characterized by relationships and behavioral aspects, which should be more concerned and managed.

The interviews are invaluable to increase insights of P&A approach as well as upstream O&G construction projects. The most pertinent issues are carrying out a feasibility study and increasing understanding of P&A prior to its application and/or implementation. In addition, most consortium projects are based on a win-win philosophy, however, unfortunately involved parties are busy to look after their own profits, in turn, the philosophy becomes and remains as “mere puff or buying-in”. Moreover, “the power trip” of clients is illustrated, which hampers better quality of work. Also the leadership skills of a project director and manager are emphasized that affects a working environment in projects. The egoism and opportunism behaviors are pointed out as the chronical problems in projects.

The limitations of this thesis is that from the survey result, only 14% of the respondents have experiences working in P&A projects and 86% of respondents do not have. In addition, the response/participation rate is not high (113 respondents).

This thesis attempts to provide guidelines for benchmarking relationship-based contracting and its performance measurement in order to handle complex procurements and achieve continuous improvement in upstream O&G construction projects. This research can be extended to a project-base for an in-depth research by using other qualitative and quantitative methods (e.g. Delphi method and other SPSS tools) in a global sense (e.g. other Asian ship yards companies/organizations) to pursue sustainable development of the upstream O&G industry.

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Appendix A: Key Elements of Partnering and Alliancing from the Literature Review

	1. Trust	2. Commitment	3. Mutual objective and goals	4. Win-win scenario	5. Conflict and problem resolution	7. Effectiveness of Management board/system	8. Contractor selection	9. Partnering and alliance tools	10. Continuous evaluation and improvement	11. Risk/reward sharing mechanism	12. Early involvement/empowerment	13. Flexibility to changes/change management	14. No-blame culture	15. Effective communication	16. Clear role and responsibility	17. Co-operation and collaboration
Aarseth et al. (2012)			✓		✓	✓		✓	✓						✓	
Black et al. (2000)	✓	✓		✓										✓	✓	
Jones (2012)	✓	✓		✓		✓	✓		✓	✓			✓			✓
Chan et al. (2004)	✓	✓			✓									✓	✓	
Clay et al. (2004)	✓		✓		✓			✓	✓					✓		✓
Crowley et al. (1999)	✓	✓	✓	✓	✓					✓						

Eriksson (2010)			✓		✓		✓	✓	✓	✓	✓	✓		✓		✓
Walker & Hampson (2008)	✓	✓	✓		✓				✓	✓			✓	✓		
Jefferies et al. (2014)								✓	✓		✓	✓		✓		
Lloyd-walker et al. (2014)	✓	✓					✓		✓	✓			✓			✓
Naoum (2003)	✓		✓	✓	✓				✓		✓				✓	✓
Sapng & Rieman (2014)	✓				✓					✓		✓		✓		
Walker et al. (2002)	✓	✓	✓			✓	✓	✓						✓		✓
Yeung et al. (2007a)	✓	✓	✓	✓	✓		✓	✓		✓				✓		✓
Total no. of elements	11	8	8	5	9	3	5	6	8	7	3	3	3	9	4	7

Appendix B: Key Performance Indicators of Partnering and Alliancing from the Literature Review

	1. Cost	2. Quality	3. Time	4. Schedule	5. Value and Profit	6. Health and Safety	7. Environment	8. Client's satisfaction	9. Job and participants' satisfaction	10. Innovation and improvement	11. Functionality	12. Trust and Respect	13. Commitment from senior management	14. Effective communication	15. Harmonious working relationship	16. Employee's attitude	17. Litigation occurrence and magnitude	18. Problem resolution process/workshop	19. Resource utilization/commitment
Crane et al. (1999)	✓	✓	✓	✓		✓				✓		✓		✓		✓	✓	✓	✓
Chan and Chan (2004)	✓	✓	✓		✓	✓	✓		✓		✓								
Cheung et al. (2003a)	✓	✓	✓			✓	✓							✓	✓			✓	
Cheung et al. (2003b)		✓				✓			✓		✓			✓	✓			✓	✓
Ibrahim et al. (2013)												✓	✓	✓					

Jefferies et al. (2014)		✓		✓		✓	✓												
Yeung et al. (2007)	✓	✓	✓		✓	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	
Yeung et al. (2008)	✓	✓	✓							✓		✓	✓	✓					
Yeung et al. (2009)	✓	✓				✓		✓		✓		✓		✓					
Total no. of indicators	6	8	5	2	2	7	4	2	3	4	2	5	3	7	2	2	2	4	2

Appendix C: Questionnaire Survey Form

1. Please indicate the type of organization in which you are working or you have worked. (Tick where applicable.)

Type of organization	Answer
Rig-owner/operator	
Main contractor	
Sub-contractors	
Suppliers	
Client	
Other:	

2. Please indicate the size of your organization.

Size of organization	Answer
100 staff	
101-500 staff	
Over 500 staff	

3. How many years/long have you worked in the upstream oil and gas industry/projects?

No. of years	Answer
1 year or less	
1 year - 3 years	
3 years - 5 years	
5 years - 10 years	
10 years or more	

4. Have you heard, or did you know about “partnering and alliancing”?

Yes	
No	

5. How do you feel and/or think about this “partnering and alliancing” and “performance measurement”?

Very positive	
Positive	
Not interested	
Negative	
Very negative	

6. Have you involved/participated in partnering/alliancing projects? If so, please indicate your experience in participating partnering/alliancing.

No, I don't have any experience in participating partnering/alliancing.	
Hands-on experience with 1	
Hands-on experience with 2-5	
Hands-on experience with 5 or more	

7. The elements listed below, considered as key elements of partnering/alliancing. Which element(s) is/are important and to want extent in your opinion (scale from 1 to 5)?

(1=least important, 2=slightly important, 3=important, 4=very important, 5=most important)

Key Elements	**1**	**2**	**3**	**4**	**5**
Trust					
Commitment (all levels - from top to bottom)					
Risk and reward sharing mechanism					
Mutual objectives and goals					

Partnering and alliancing tools (e.g. team building, workshop, facilitator)					
Conflict and problem resolution					
Continuous evaluation and improvement					
Effective communication					
Clear role and responsibility					
Cooperation and collaboration					
Win-win scenario					
Contractor selection (e.g. based on competence instead of low-bid selection)					
No-blame culture					
Effectiveness of management board					
Flexibility to change and change management					
Early involvement and empowerment					

8. Performance indicators (PIs) listed below, considered as KPIs of partnering/alliancing. Which indicator(s) is/are most important and to what extent in your opinion (scale from 1 to 5)?

(1=least important, 2=slightly important, 3=important, 4=very important, 5=most important)

Key Performance Indicators (KPIs)	**1**	**2**	**3**	**4**	**5**
Quality					
Health and safety					
Effective communication					
Cost					
Time					
Trust and respect					
Environment					

Innovation and improvement					
Problem resolution process and workshop					
Job and participants' satisfaction					
Commitment from senior management					
Value and profit					
Client’s satisfaction					
Functionality (fulfillment of intended functions at the end of the day)					
Harmonious and cooperative working relationships					
Employee's attitude					
Resource utilization and commitment					
Litigation occurrence and magnitude					
Schedule					

9. Any comments or opinion

Appendix D: Performance Profile

	Rating: (Circle one)					
Measurement Criteria	Always	Most of the time	Usually	Some times	Rarely	Never
Safety/Health/Environment Proactive stance on design safety	5	4	3	2	1	0
	Comments:					
Responsiveness Understanding and responding to customer's goal Responding to changing business needs	5	4	3	2	1	0
	Comments:					
Flexibility Change management Flexibility in accommodating site/business-specific needs	5	4	3	2	1	0
	Comments:					
Planning Adherence to Project Execution Plan	5	4	3	2	1	0
	Comments:					
Teamwork/Partnership Effective involvement of project team Develop ownership around project strategy and risk Effective dissemination of	5	4	3	2	1	0
	Comments:					

information through team Effective feedback Trusting environment Team members involved Effective coordination of consultants and other resources	

(Source : Crane et al., 1999)

Appendix E: Quantitative Indicators (QIs) for Key Performance Indicators (KPIs)

KPIs	QIs
Time	Variation of actual completion time expressed as a percentage of finally agreed completion time Time improvement Perceived key stakeholders' satisfaction scores by using Likert scale
Cost	Variation of actual project cost expressed as a percentage of finally agreed project cost Cost improvement Composite cost performance score by using Likert scale
Top management commitment	Partnering development cost of project expressed as a percentage of total project cost Percentage of top management attendance in partnering meeting Measuring level of top management commitment by using Likert scale
Quality	Cost of rectifying major defects or non-conformances of a project expressed as a percentage of total project cost Average number of non-conformance reports generated per month Perceived key stakeholders' satisfaction scores by using Likert scale
Trust and Respect	Average duration for settling variation orders and EOT claims

	Frequency of meeting another party's expectation Perceived key stakeholders' satisfaction scores by using Likert scale
Effective communication	Reduction of written communication Variation of the no. of formal letters and e-mails sent between parties per month against the number with previous similar projects Perceived key stakeholders' satisfaction scores by using Likert scale
Innovation and Improvement	Cost saving resulting from expressed as a percentage of total project cost No. of innovative initiatives introduced Perceived key stakeholders' satisfaction scores by using Likert scale

(Source: Yeung et al., 2009)