AMERICAN UNIVERSITY OF BEIRUT

EVALUATING SPV STAKEHOLDER INTEGRATION ON PPP PROJECTS

by
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A thesis
submitted in partial fulfillment of the requirements
for the degree of Master of Engineering
to the Department of Civil and Environmental Engineering
of the Faculty of Engineering and Architecture
at the American University of Beirut

Beirut, Lebanon
September 2018

AMERICAN UNIVERSITY OF BEIRUT

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ACKNOWLEDGMENTS

First and foremost, I would extend my deepest gratitude to my parents, Bayan and Makram, for their limitless support always. A thank you stands feeble compared to all you've done and I hope to always live up to your expectations.

To my thesis advisor Dr. Farook Hamzeh, I thank you for your continuous assistance, trust, and most of all – patience – throughout the ups and downs of this journey. Our hard work sure paid off in the end!

I would like to thank all my thesis committee members for their interest and valuable input regarding the topic: Drs. Abou Najm and Abdul Malak, for their academic perspective of things, and Mrs. Hayek and Nakat, for their practical experience. Your involvement means a lot.

Finally, many thanks to all who participated in the survey and provided their comments and evaluations. Additionally, for all the case study participants who volunteered the time to be interviewed over several hours, your contribution made my thesis what it is.

AN ABSTRACT OF THE THESIS OF

Zeina Makram Malaeb for Master of Engineering
Major: Civil and Environmental Engineering

Title: Evaluating SPV Stakeholder Integration on PPP Projects

A Public Private Partnership (PPP) describes an arrangement between the public and the private sectors for providing a public asset or service. One of the most distinguishing features of PPPs is the presence of a singular entity, the Special Purpose Vehicle (SPV), which is the organization representing the private sector that is responsible for the financing, design, construction, operation, and maintenance of the project over a long-term period. This SPV combines a number of stakeholders including the Design-Build Contractor and the Operations and Maintenance Contractor under one umbrella, and together these stakeholders are responsible for delivering a successful project. Consequently, the key to ensuring successful project delivery is the efficient management and integration of the various stakeholders involved to deliver the project as a unified SPV team. However, the stakeholder management role of the SPV is highly under-investigated in the literature and there exists a gap regarding the SPV's internal stakeholder relationships and interactions. Additionally, no studies exist that attempt to investigate the degree of stakeholder integration within the SPV. Therefore, there is a significant need to investigate and evaluate the efficiency of SPV stakeholder integration, considering that it is both a prerequisite and driver of PPP project success. This research aims to address this need through a focused study on the SPV organization and an evaluation of its management efficiency in terms of stakeholder integration. This study proposes metrics to measure SPV collaboration, projected from other integrated project delivery systems, and henceforth develops a "Health-Check" tool to evaluate the overall degree of SPV stakeholder integration. The tool is applied to a well-recognized PPP airport project in the Middle East to assess the level of collaboration between the different project participants and identify shortfalls. The significance of this research is twofold. First, it fills a significant gap in the PPP literature by investigating the stakeholder management mechanisms of the SPV in reality. Second, it is the first of its kind that aims to evaluate the SPV's integration level as an enabler of successful relationship management.

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EQUATIONS

ABBREVIATIONS

AHP: Analytical Hierarchy Process

BIM: Building Information Modeling

DB: Design-Build

DBB: Design-Bid-Build

EPC: Engineer-Procure-Construct

IPD: Integrated Project Delivery

O&M: Operations and Maintenance

PA: Project Alliancing

PPP: Public-Private Partnership

SPV: Special Purpose Vehicle

CHAPTER 1
INTRODUCTION

This chapter presents the research background which comprises a brief overview of PPP projects and their characteristics, the central role of the Special Purpose Vehicle (SPV) in the management and coordination of stakeholders, and the significance of stakeholder integration in PPP project delivery. This paves the way for the presentation of the research motivation and significance. Finally, the research process and organization of the thesis are outlined.

1.1. Research Background and Overview

Public Private Partnerships (PPPs) describe an arrangement between the public and the private sectors for providing a public asset or service. PPPs allow the public entity to benefit from private financing and utilize the private sector's skills and expertise in project delivery, and offer improvements in project implementation time, whole life-cycle costs, and service quality (Leiringer, 2006; Liu et al., 2015). PPPs are characterized by their long-term nature, bundling of project functions, complex contractual agreements, and distinct risk allocation formulas (Grimsey and Lewis, 2004), all of which set them apart from traditional procurement routes. One of the most distinguishing features of PPPs is the presence of a new entity, the Special Purpose Vehicle (SPV), which is the organization representing the private sector, formed especially to undertake the PPP contract. The SPV organization in PPP project delivery is responsible for the financing, design, construction and subsequent operation and maintenance of the built facility (Gomez and Gambo, 2016).

This organization combines a number of stakeholders including the Design-Build Contractor and the Operations and Maintenance Contractor under one umbrella, and together these stakeholders are responsible for delivering a successful project as one unified entity. This combination of stakeholders calls for several unique features, namely: early stakeholder involvement, alignment of stakeholder goals and interests, stakeholder integration, collaborative working, innovation potential, and long-term commitment, among others (Fischbacher and Beaumont, 2003; Leiringer, 2006; Sainati et al., 2017).

The key strategic function of the SPV is the effective coordination of service delivery in order to deliver a successful project (Tranfield et al., 2005). Since the SPV is comprised of several organizations all working to provide essential services to the project, this coordination necessitates efficient relationship management of the different stakeholders involved by understanding their roles, interactions, and interdependencies. A fundamental cornerstone of efficient SPV management is stakeholder integration, as it is a function called for by both the SPV structure and the PPP delivery system. The significance of SPV integration is further attested by the fact that value on a project is added through people, and mostly generated through relationships and interactions, which makes stakeholder collaboration pivotal to add service value, increase client satisfaction, and achieve overall success (Smyth and Edkins, 2007). This is especially true when considering PPP projects, as their procurement route and stakeholder engagement processes necessitate solid organization and control.

Studies on internal SPV relationships are scarce in PPP literature and SPV stakeholder interactions seem to be under-investigated as existing research diverts its focus to the overall SPV-Public Authority interface (Clifton and Duffield, 2006; Reeves, 2008; Zou et al., 2014). However, some researchers did attempt to investigate these internal relationships. Edkins and Smyth (2006) surveyed key PPP stakeholders in the United

Kingdom in order to explore their internal perceptions of project stakeholder relationships. Their findings showed that relationship management within the SPV has developed and yet is still fragile, being too dependent on individual behaviors rather than active organizational development. Symth and Edkins (2007) further concluded that this development of relationships within the SPV, while representing an improvement from the historic adversarial behavior on traditional projects, is merely a passive reaction to the structural change instilled by the PPP procurement route. Walker and Jacobsson (2014) stressed on the need for close collaboration and team integration between PPP participants, citing formal incentive agreements as a driver for the former.

In short, these findings highlight the necessity of having an effective relationship management framework that accounts for the integration of the different organizations within the SPV. Although the afore reviewed studies attempt to clarify stakeholder relationships at the internal SPV level, they do not specifically investigate nor evaluate the level of stakeholder integration within the SPV. PPP project success is strongly affected by the efficiency of stakeholder integration as PPPs necessitate solid collaboration for successful service delivery. This notion proposes a correlation between the SPV's delivery route and other project delivery systems founded on integration. The Integrated Project Delivery (IPD) system, in specific, describes that the factors for realizing efficient stakeholder integration stem from three foundations: organizational structures, commercial frameworks, and operating systems and processes (Thomsen et al., 2009).

1.2. Research Motivation and Significance

Based on the previous discussion, the key to ensuring successful PPP project delivery is the efficient management and integration of the various stakeholders involved throughout the project life cycle. However, the relationship management role of the SPV is

highly under investigated in the literature and there exists a gap regarding the SPV's internal stakeholder relationships and interactions. In fact, Sainati et al. (2017) most recently stated that project management researchers have never focused expressively on SPVs and therefore it is challenging to get a clear understanding of what the SPV is and what it does. The authors further highlighted the necessity of further exploring the role of the SPV, primarily in relation to its ability to coordinate critical project stakeholders. In addition, McErlane et al. (2016) concluded that existing literature fails to efficiently address inherent relational matters as there is a knowledge gap concerning PPP stakeholders. Therefore, there is a need to investigate and evaluate the efficiency of the SPV's management role, in terms of stakeholder integration, seeing that it is both a driver and a prerequisite for PPP project success. Considering the significance of stakeholder integration for the SPV, and thus its connection to integrated project delivery systems, added to the fact that literature on the latter is rich with research on integration, there is an opportunity for projecting such concepts onto the SPV evaluation framework.

This research aims to address this need through a focused investigation and evaluation of SPV stakeholder integration. The overall aim of this study is the development of a tool that measures the degree of stakeholder integration within the SPV based on characteristics of the PPP procurement route. The significance of this research is twofold. First, it fills a significant gap in the PPP literature by investigating the stakeholder management mechanisms of the SPV in reality. Second, it is the first of its kind that aims to evaluate the SPV's integration level as an enabler of successful relationship management.

1.3. Research Process

This research follows a well-designed process that identifies problems and research gaps in this area of study, formulates a set of research questions, and achieves the

research objectives through a strategized research methodology. The primary step of the process comprises an overview of the available literature and previous studies on PPP projects, SPV structures and characteristics, functions of integrated project delivery systems, and measures of stakeholder integration. Then, problems and research gaps related to evaluating SPV stakeholder integration are identified, which pave the way to developing the research objectives. Afterwards, specific research questions are set and used as a guidance for designing the research methodology. Subsequently, this study proposes metrics to measure SPV collaboration, projected from other integrated project delivery systems, based on the three foundations of IPD: organization structures, contractual frameworks, and operating systems and processes. The relative significance of these factors is rated using the Analytical Hierarchy Process (AHP) through a survey addressed to industry professionals. An "SPV Health-Check Tool" is developed, based on the identified factors, to evaluate the degree of SPV stakeholder integration. The tool is applied to a well-recognized PPP airport project in the Middle East to assess the level of collaboration between the different project participants and the results analyzed to identify shortfalls and draw conclusions.

1.4. Organization of the Thesis

The organization of this thesis is presented in Figure 1 below.

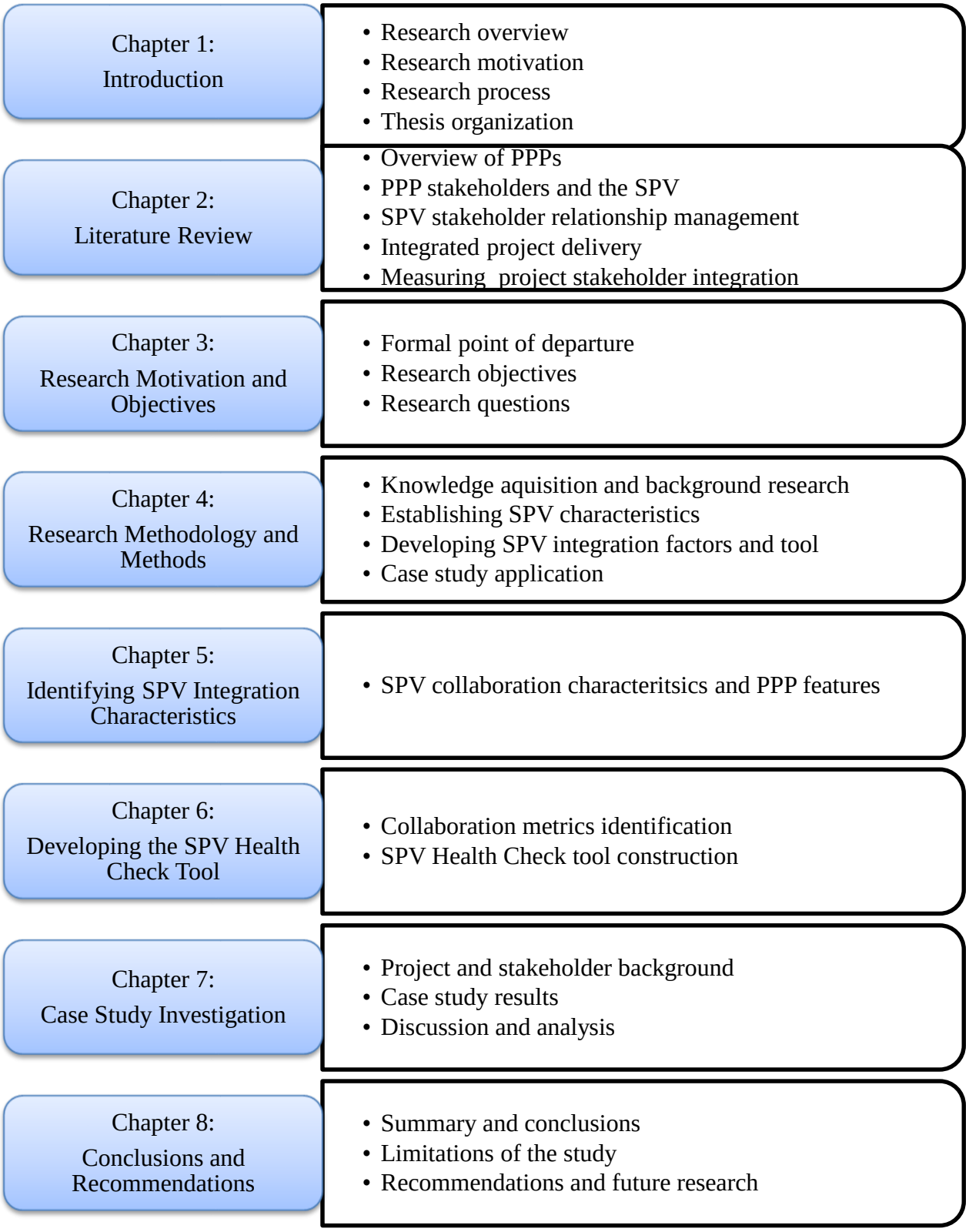


Figure 1: Thesis Organization

CHAPTER 2
LITERATURE REVIEW

This chapter reviews the relevant research needed for this study. First, an overview of Public Private Partnerships (PPPs) is presented along with their main features and types. Next, the chapter zooms in to the Special Purpose Vehicle (SPV) and delineates its structure and agreements. Following from that, the SPV's main role of stakeholder integration and relationship management is highlighted. Studies on relationship management within the internal SPV organization are then presented and the need for their further investigation is emphasized. This is followed by an introduction to the concept of project stakeholder integration, with a focus on the Integrated Project Delivery system (IPD), and its implementation on three project delivery fronts: organization structures, commercial frameworks, and operating systems. The management and operations of the SPV are linked to the concepts of the IPD system, in terms of their common foundation: stakeholder integration. Studies that attempted to investigate and measure project stakeholder integration are reviewed last.

2.1. Overview of Public Private Partnerships

2.1.1. Definition and Main Features

According to the World Bank (2009), a PPP is a new procurement route, contract, and relationship type. Primarily, this procurement route is distinguished by the bundling of the different project phases, from financing to operation, in one package and granting it to one private party that assumes its responsibility. It proposes a new contractual scheme due to its different perspectives on risk allocation and performance specification, as well as its

long-term nature (Zhang, 2005). Finally, PPP projects create unique relationships between the different stakeholders, especially at the level of the SPV in charge of delivering the project. The public sector's reasons for adopting PPPs are twofold: (1) they allow the public sector to benefit from private financing which relieves the stress on limited public budgets, and (2) they allow the public sector to utilize the private sector's skill and management expertise in project delivery (Osei-Kyei and Chan, 2015). In fact, PPPs are claimed to offer a range of benefits such as accelerated infrastructure provision, timely project implementation, reduced whole life cycle costs, reduced pubic risk, and improved service quality and innovation (Leiringer, 2006; Liu et al., 2015).

2.1.2. Types of PPP Arrangements

In general, PPPs span over a range of approaches involving the utilization of private sector resources to deliver services and/or facilities for public use (Zhang, 2005). The term PPP can be used to describe a wide spectrum of procurement routes, depending on the division of roles and risks between the public and private sectors as shown in Figure 2 below. At the bottom end of the spectrum, where the private interference is minimal, we have the traditional project delivery routes and service or management contracts. At the upper end of the spectrum, we have full privatization. Both of these boundaries are excluded from PPPs. Within these boundaries, the different forms of PPP arrangements include: Build Operate Transfer (BOT), Build Transfer Operate (BTO), Build Own Operate Transfer (BOOT), Design Build Finance Operate (DBFO), Design Build Operate Maintain (DBOM), and Design Construct Manage and Finance (DCMF), among others.

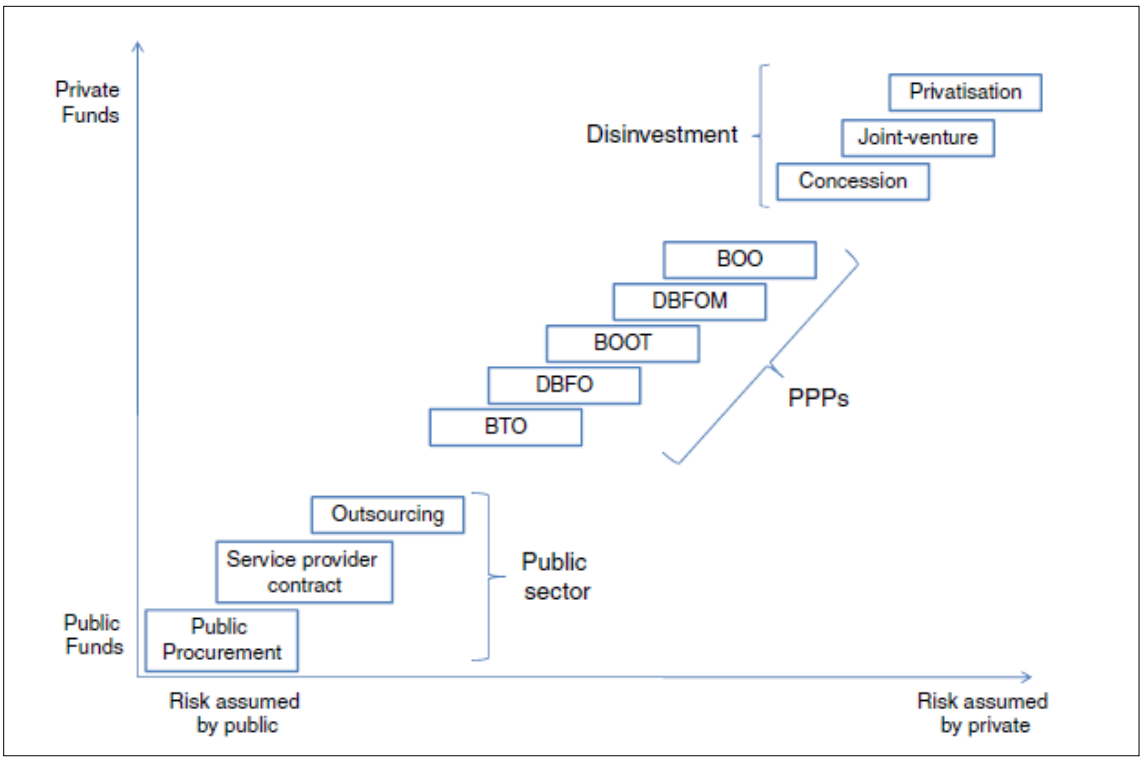


Figure 2: Range of PPP Types (Sarmento and Renneboog, 2016)

Although there seems to be a vast array of different arrangements within the PPP boundaries, all these structures encompass similar basic characteristics, the only difference being the division of risks along different project phases (Osei-Kyei and Chan, 2015). In this research, we consider in specific the BOT model of PPPs, which is one of the most popular (Zhang and Kumaraswamy, 2001). In fact, other models may differ from BOTs in one or more particular aspects, but are considered variations within the BOT scheme. In BOT projects, the private entity is required to (1) Build (including finance, design, manage project execution, procure, and construct), (2) Operate (including manage and operate the facility, maintain the facility, and deliver the service), and (3) Transfer the facility to the public client at the end of the contract period (Kumaraswamy and Zhang, 2001).

2.2. PPP Stakeholders and the SPV

2.2.1. PPP Stakeholders: The Public Authority and the SPV

Although contractual and financial characteristics may vary between different PPP project settings, BOT models tend to share a similar basic structure (Savvides, 2016). This structure involves two main project stakeholders: the public authority and the private entity. The private sector is represented by a project company called the Special Purpose Vehicle (SPV). This SPV enters into a contractual agreement with the public authority for the financing, designing, building, management and operating of a public facility (McErlane et al., 2016). This contract is of a long term nature, usually for 30 or more years (Sarmento and Renneboog, 2016). By analogy to traditional procurement, one may compare the SPV to the contractor of a client organization. The client, who is the public authority in this case, has a single point of contact with the SPV throughout the project life span (Tranfield et al., 2005). The public authority is responsible for defining the business case, determining project objectives, planning and executing the procurement process, and governing the contract to ensure that outcomes are delivered to the required standards (Grimsey and Lewis, 2004; McErlane et al., 2016). In concept, the public authority has an overseeing or supervisory role in the project, however, the SPV is the party responsible for the direct management (Wilson et al., 2010). All major project operations happen at the level of the SPV as it is the primary participant in PPP project delivery.

2.2.2. SPV Structure, Stakeholders, and Agreements

The following section describes the SPV structure that this research focuses on. In our study, we consider the setting where the private sector is a consortium of different parties collectively operating through the SPV. These parties, who are the SPV

stakeholders, together collaborate to deliver the project as one unified SPV. The SPV consortium involves financing organizations, equity shareholders, construction contractors, and operating contractors, among others.

In order to carry out the PPP project contract, the SPV enters into different agreements with a number of organizations (Grimsey and Lewis, 2004). In fact, the SPV acts as the central hub for legal manifestation on the PPP project, as all project agreements with various parties are only accorded with it (Chowdhury et al., 2012). Figure 3 below presents a typical PPP structure along with the different types of agreements. There are five main agreements that are core to the SPV organization:

1. The project agreement: this is the main agreement between the SPV and the Public Authority, often referred to as a concession agreement. This contract is complex and encompasses an array of issues pertaining to the conditions of financing, design, construction, operations and maintenance, and payment structures, among others (Sarmento and Renneboog, 2016).
2. The debt funding agreement: a main source of PPP project funding comes from financial institutions in the form of debt or loans. In fact, a benchmark figure for the financing structure would be 80-90% debt, and 10-20% equity (Grimsey and Lewis, 2004; Sarmento and Renneboog, 2016).
3. The equity funding (shareholders) agreement: the remaining project financing comes from SPV shareholders in the form of equity. Traditionally, the main project contractors, which are the Design-Build contractor and the Operations and Maintenance contractor, are part of the shareholders financing the project (Grimsey and Lewis, 2004; McErlane et al., 2016). In fact, this is the project setting considered in this research.
4. The construction contract: this is the contract signed with a Design-Build contractor to design and construct the facility (McErlane et al., 2016).

5. The service contract: this is the contract signed with an Operations and Maintenance contractor who is ultimately responsible for the operations of the infrastructure (McErlane et al., 2016).

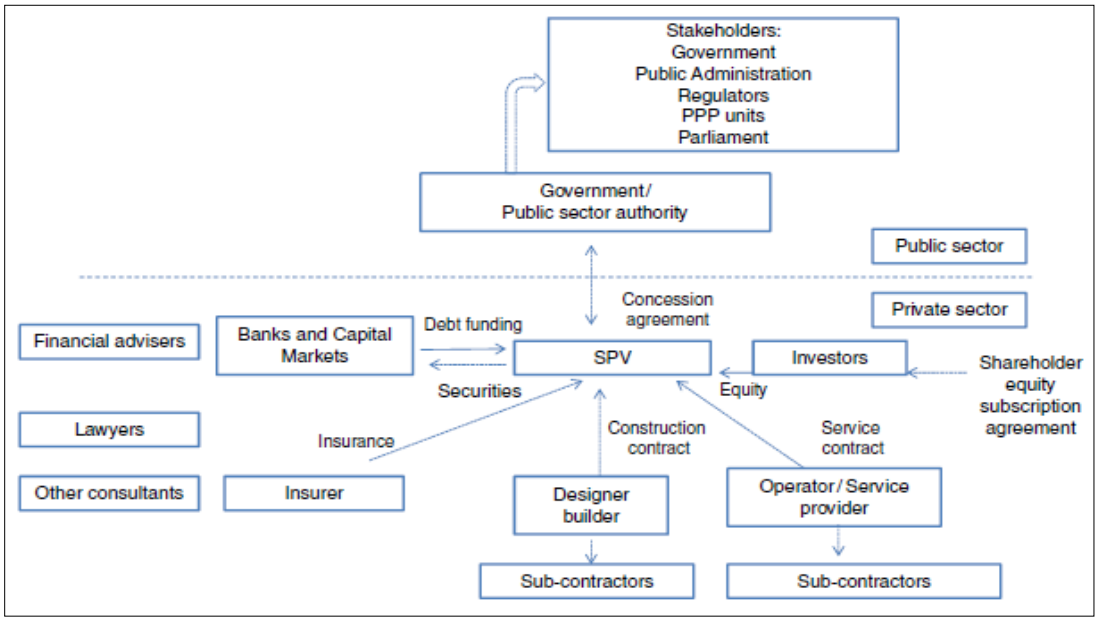


Figure 3: SPV Structure and Agreements (Sarmento and Renneboog, 2016)

As previously implied, the public entity, in concept, has minimal interference with delivering the PPP project at the internal level. Additionally, the business of financing institutions falls outside the scope of service provision and delivery as they play a mostly external commercial role. The entities of the SPV that are directly in charge of providing services and managing project operations, and are in frequent interaction are the Design-Build contractor and the Operations and Maintenance contractor. Therefore, as the purpose of this research is to investigate the internal SPV interactions at the project level, the main internal SPV stakeholders we are interested in investigating are the contractors, from a facility construction and operations point of view. Furthermore, the setting we consider describes that both these contractors act as equity shareholders in the SPV. This is referred to as a "contractor-led consortium" in which the equity shareholders and the service

providers are the same entity (Gruneberg and Hughes, 2004). In reality, these two contractors come together from day one, arrange project financing through equity and debt, and bid for the PPP project as one unified entity, which will later be formalized as the SPV that enters into the PPP project contract.

2.3. Stakeholder Relationship Management in SPVs

2.3.1. Understanding SPV Relationships

Several researchers have stressed the importance of relationship management for PPP projects, considering the concept critical for this procurement route in specific, as PPPs represent distinct stakeholder structures and complex networks of interactions over long periods of time. However, the great majority of these researchers seem to focus on the Public-Private sector interface and overlook the relationships within the internal SPV environment. The SPV has been identified as a chief reason for the success of PPPs (Chowdhury et al., 2012). Hence, it is necessary to explore its internal functioning and management as an enabler for successful project delivery. In other terms, it is essential to study how the internal SPV stakeholders work together in providing their respective services. This is especially true since the SPV is the party that takes responsibility for the project over a significantly long period; therefore, service delivery is happening at the SPV level and as a result of its internal processes and interactions. Consequently, this highlights the necessity for investigating relationships at the internal SPV organization interface as their efficient management is a prerequisite for PPP project success.

McErlane et al. (2016) attempted to investigate these interactions, which he referred to as micro-level relationships, throughout the different phases of a PPP project. According to the authors, the SPV will unbundle the required services along the project phases and assign roles and responsibilities to the various SPV stakeholders. This results in

different stakeholders having varying levels of involvement, power, and interest throughout the project. During the procurement phase, the project financers take the lead in organizing the SPV and negotiating with the public authority, which gives them high levels of power and interest. On the other hand, the contractors (DB contractor and O&M contractor) are not yet directly involved in the provision of services and therefore hold lower degrees of interest and power. During the construction phase, which follows project procurement, these micro relationships change. Financers are now less involved as their power and interest decreases. The main participant now is the DB contractor, as he is directly involved in the provision and commissioning of the asset, and thus possesses high levels of power and interest. In this phase, the O&M contractor does have a secondary role, although he is not directly involved in providing services. His role here relates to providing input into the design and communicating with the DB contractor to ensure the effective life-cycle functioning of the asset. During the operations phase, the roles shift again and the O&M contractor now takes the lead and is responsible for facility performance. The authors further concluded that there is a significant knowledge gap relating to PPP stakeholders and their interactions that existing literature fails to address. This research is assumed to be one of the few to address this gap.

Edkins and Smyth (2006) and Smyth and Edkins (2007) also explored the SPV in terms of relationships of at the aggregate level within the SPV organization. According to the authors, there exists an inherent theoretical incentive for SPV participants to maintain harmonious relationships as a result of the long-term nature of the project which implies long periods of the same staff working together. Therefore, it is vital to investigate these relationships and understand them in order to effectively manage them. Their methodology consisted of a traditional questionnaire survey, directed to key PPP stakeholders, which required them to rate their relationships with other stakeholders in order to measure the

closeness of relations among key players. The data collected through the survey related to the perceptions of relationships and relationship management, with a particular focus on the concept of trust, amongst the different PPP stakeholders. The findings revealed that there exist reasonable levels of trust components within the SPV, and therefore sound relationships that represent improvements from the traditional adversarial behavior of stakeholders on construction projects. However, this relational aspect is found to be fragile, as it relies primarily on behavior of individuals as opposed to organizational level support and development. In reality, SPV organizations appeared to be reactive rather than proactive in managing relationships, as relationships were not a focus of management activity. The authors stressed the need to provide organizational investment in terms of leadership, systems, and procedures in order to ensure active trust development and provide the scope for relationship improvement by integrating relationship management principles.

Walker and Jacobsson (2014) investigated a rare case study in which a project alliance (PA) was undertaken within a PPP delivery approach, in order to explore the possibility of linking PA with PPP. A PA agreement is one form of integrating project stakeholders, through which two or more parties commit to work collaboratively, share risks and rewards, and make unanimous decisions on main project issues. The premise of an alliance agreement is the joint management of project risk as participants are bound together through project performance, as opposed to individual stakeholder performance. In the case study, the Design Build contractor entered into an alliance agreement with his Mechanical and Electrical subcontractor during the design and construction phase, with the DB contractor assuming the role of a "quasi project owner". The main driver for the PA agreement was the need for close collaboration and team integration on the PPP project. This called for forming a formal incentive agreement in the form of a gain share/pain share agreement, since soft issues (e.g. motivation) were not sufficient to alone drive

collaboration. This pain sharing and gain sharing agreement on the project implied a joint "sink-or-swim" mentality among the PA members. These incentives are fundamental in creating trust, commitment, a blame-free environment, and a unified sense of responsibility and accountability, all of which eventually drive cooperation. The findings from the case study revealed that it is possible to integrate a number of valuable features of PAs into PPP projects. Some of these include: close collaboration for a best-for-project approach by all stakeholders, stronger knowledge sharing across teams, enhanced communication between stakeholders, and reduced wasted effort on disputes, blame, and litigation. Finally, the study concluded that there is an opportunity for designing a PA approach within PPPs as long as the stakeholders fully understand and commit to this decision.

2.3.2. SPV's Core Role: Stakeholder Integration

Having a strong private consortium has been cited as a critical success factor for PPP projects (Wegrzyn, 2016; Zhang, 2004(a)). As this SPV involves a number of stakeholders together responsible for PPP project delivery, the "strength" of this consortium is predominantly influenced by its stakeholder structure and compatibility (Osei-Kyei and Chan, 2015). In fact, based on the British Treasury Taskforce's "Award Criteria for Winning Tender in PFI Projects", the SPV consortium should be a fully cohesive entity. In order to win the PPP project award, the SPV should prove that its various stakeholders are working together through a unified and collaborative approach (Zhang, 2004(a)). An increasingly important criterion for selecting an SPV is the potential for "relational integration" (Kumaraswamy et al., 2007). Therefore, this highlights the importance of achieving efficient stakeholder integration in the SPV.

PPP projects, being service-delivery focused, tend to rely on high levels of cooperation and teamwork from the outset of the project. For example, design for service

delivery requires input from downstream contractors in order to take constructability and serviceability issues into consideration (Tranfield et al., 2005). Research on this issue concluded that the success of service-delivery type projects depends on the quality of the relationships of the involved participants (Tranfield et al., 2005). Furthermore, a particularly cooperative PPP was identified as a prerequisite for successful project procurement (Kumaraswamy and Zhang, 2001). Therefore, effective organization is required to manage SPV stakeholder relationships; this is achieved primarily by understanding the interfaces and interactions between the collaborating stakeholders.

2.3.3. Need for Further Research on SPV Relationships

Although a number of studies have attempted to explore internal SPV relationships, none seem to specifically investigate nor evaluate the level of stakeholder integration within the SPV. Researchers have attested to the fact that SPV organizations, in terms of their roles from a stakeholder management perspective, appear to be under investigated despite their fundamental role in PPP project delivery (Sainati et al., 2017). In addition, the literature is missing essential information related to the internal interactions of SPV stakeholders (McErlane et al., 2016). From the studies reviewed above, it is apparent that relationship management in PPPs is fundamental to ensure project success, particularly at the level of the SPV. The SPV has the chief role of managing these relationships by enabling and actualizing collaboration and integration among the project stakeholders.

A fundamental cornerstone of efficient SPV management is stakeholder integration, as it is a function called for by both the SPV structure and the PPP delivery system. Therefore, there is a need to investigate and evaluate the efficiency of SPV stakeholder integration, seeing that it is both a driver and a prerequisite for PPP project success. This notion proposes a correlation between the SPV's management operations and

concepts of official project delivery systems based on stakeholder integration. A popular model of the latter is the Integrated Project Delivery (IPD) system. IPD philosophy describes that the factors for realizing efficient stakeholder integration stem from three foundations: organizational structures, commercial frameworks, and operating systems and processes (Thomsen et al., 2009). An overview of the concepts of IPD is presented next.

2.4. Integrated Project Delivery

2.4.1. Introducing the Integrated Project Delivery (IPD) System

Integrated Project Delivery (IPD) is a project delivery method structured to overcome several basic problems faced by the construction industry, from the adversarial nature of stakeholder relationships to low productivity rates, high rates of rework, and time and cost overruns (Thomsen et al., 2009). The core principle and goal of IPD is clearly stated in its title: Integration. IPD aims to integrate the different stakeholders on a project to form an operative team that focuses on the overall project goals. According to the American Institute of Architects (AIA), IPD is "a project delivery approach that integrates people, systems, business structures and practices into a process that collaboratively harnesses the talents and insights of all participants to optimize project results, increase value to the owner, reduce waste, and maximize efficiency through all phases of design, fabrication, and construction." (AIA, 2007). Some principles of IPD identified by the AIA are: mutual trust and respect, mutual benefit and reward, collaborative innovation and decision making, early involvement of key participants, open communication, and effective organization and leadership. Another concept IPD proposes is a multiparty agreement between the main stakeholders to align the business interests of all parties. Projects can still gain from integrating IPD features without this type of agreement, but using a multiparty agreement is thought to reduce the risk of major disputes (Sun et al., 2015).

2.4.2. Relating IPD to the SPV

The overall concept of the PPP delivery system, from the bundling of the project phases to the integration of the private sector contractors under one umbrella, seems to bear significant similarities to the IPD philosophy. PPP project success is strongly affected by the level of stakeholder integration as PPPs necessitate solid collaboration for successful service delivery. In fact, performance levels in infrastructure development are seen to depend as much on enhanced project cultures and integrated teamwork as they do on improved structures and systems (Kumaraswamy et al., 2007). PPPs, being of a long term nature, provide opportunities to generate, mature, and sustain cooperation and also for the benefits to materialize (Kumaraswamy and Anvuur, 2008).

This integration, according to IPD, stems from three foundations: organization structures, contractual frameworks, and operating systems (Thomsen et al., 2009). PPP researchers have attested to this fact, as the previously reviewed literature revealed the need for organizational investment in commercial incentives, policies, and systems in PPP projects to ensure successful management (Edkins and Smyth, 2006; Smyth and Edkins, 2007; Walker and Jacobsson, 2014). Zou et al. (2014) stated that effectively managing relationships in PPP projects cannot only depend on soft-issues but requires the concept to be reinforced by the organization through strategy, process, and systems, in addition to restructuring the project organization through the integration of different divisions of the organization.

Therefore, SPV stakeholder integration appears to be a fundamental cornerstone of the PPP delivery system, which brings forwards its correlation to the IPD system. Thomsen et al. (2009) detail the requirements that should be addressed in a project delivery system in order to ensure effective stakeholder integration. As mentioned above, this is dealt with on

three fronts: the organization structure, the commercial framework, and the operating systems.

2.4.3. Organization Structures

In traditionally procured projects, each stakeholder has a separate "camp" organized vertically and separated from others by contractual walls. In addition, project participants come in at different points along the project life cycle which wastes the potential of benefiting from early stakeholder involvement. For example, the design process misses input from key downstream players which may result in inefficient design, rework, and change orders. As a consequence of this organizational structure, the project stakeholders experience lack of communication and collaboration and adversarial relationships.

IPD requires a drastic change in the organizational structure through the formation of integrated teams. Key contractors are engaged early on and collaborate with the designer by providing input on cost, constructability, and value, with the goal of decreasing negative iterations throughout the design process. Stakeholders cooperate in making decisions and solving problems. This creates a "project culture" that encourages collaborative working as a unified integrated team. Another fundamental organizational feature of the IPD is what is termed the Core Group, an executive team responsible for the day-to-day management and leadership on a project. What is special about this team is that in integrates members from the different key stakeholders in the decision making process. These people do not only serve as managers, but also as leaders that are responsible for driving and committing to the IPD system. In IPD, project organizations change from silos to integrated, high performance teams. A transformation of the organizational structure is the essential starting point to effectively implement an integrated form of project delivery.

2.4.4. Commercial Frameworks

The commercial structure on traditionally procured construction projects is built to drive local optimization of individual stakeholders' interests, with each party looking out for its own well-being and disregarding others' interests. A key missing aspect is the alignment of stakeholder goals and objectives with the overall project objectives. In order to ensure this alignment is in place, a commercial framework is required that addresses the risk allocation and compensation structures amongst participants. For instance, the IPD contract calls for collective risk management, as opposed to each party managing its own risks. Through risk sharing, all the stakeholders will actively collaborate in effectively identifying and collectively managing risks, which benefits the project as a whole. Another type of incentive introduced in these commercial frameworks is the "pain sharing and gain sharing" agreement. The idea is that all participating team members mutually share the risk of cost overruns and mutually benefit from cost savings in any part of the project. Again, this leads to a shift in mindset from each party looking out for itself to all parties looking out for the project. All involved stakeholders are part of one team with one goal, which is successful project delivery. The relationships between these major stakeholders shift from self-protecting and risk shifting to team-based ones, aligning the participants through incentives carefully chosen to encourage collective risk management and whole project optimization.

2.4.5. Operating Systems and Processes

Even with integrated teams and sufficient commercial terms in place, operating systems and processes that either facilitate or hinder collaboration can make-or-break an integrated project delivery system. The systems that project stakeholders rely on must be

integration-compatible and able to encompass stakeholder cooperation. For example, using BIM as a design software allows for the sharing of information between different participants and introduces a transparency into the project processes, which makes it a cooperative system. Another requirement is utilizing technologies to ensure effective interaction and communication between project participants.

In addition, certain project processes and mechanisms must exist that manage the interactions among stakeholders and nurture the integration potential of the project. These processes, which stem from the lean construction philosophy, promise to overcome the shortfalls of those employed in traditional project delivery systems. Examples of the former are: integrated setting of project goals and objectives, collective decision making and integrated project management, collaborative planning with key project stakeholders, and involving the last planner in the planning process. These processes and systems must be designed to add value, foster collaboration, increase reliability, and allow for continuous improvement.

2.5. Measuring Project Stakeholder Integration

2.5.1. Defining Stakeholder Integration

Project stakeholder integration is formally defined as a setting where different organizations with different goals and cultures combine into a unified cohesive and mutually supportive unit whose core function is effective collaboration for successful project delivery (Baiden et al., 2006). This integrated unit aligns stakeholder goals with the overall project goals and relies on free communication and information exchange along with collective risk management (Baiden and Price, 2011).

2.5.2. Studies on Integration Measures

A number of studies in the literature have attempted to study and measure project integration using different tools.

Pocock et al. (1996) developed a "degree of integration" metric based on the number and quality of interactions between designers and contractors on a project. The authors further related the degree of integration to project performance in terms of time, cost, and quality. The degree of integration was calculated through a questionnaire survey distributed to 25 projects with questions aimed at investigating the quality and quantity of interactions occurring between organizations on the project. The metric representing integration is calculated as the ratio of the weighted total man-hours spent on interaction to the construction duration. The study results showed that high levels of integration were associated with better time and cost performance.

Baiden et al. (2006) investigated the extent of team integration on construction projects by identifying ten key factors necessary for integration, and providing a rating of each dimension based on actual project practices as obtained from case study interviews. The ten dimensions used were: single team focus and objectives, seamless operations, mutually beneficial outcomes, increased time and cost predictability, sharing information, team flexibility, single co-located team, a no-blame culture, equal opportunity for inputs, equitable relationship and respect. Thus, the study relied on a qualitative assessment of stakeholder integration by rating the degree of achievement of each integration dimension as fully achieved, partially achieved, or not achieved. However, the authors did not provide one solid measure of team integration but only fragmented ratings of the grade of realization of the different integration factors. Biaden and Price (2011) later developed these measures into a framework that offers a single integration metric in terms of percent integration achieved. They did this by applying certain weights to the ratings and adding

the results to achieve a cumulative evaluation score (which is then expressed as a percentage).

Cheung et al. (2006) did not measure team integration per se, but calculated the degree of relationalism of construction contracts. This metric is measured using a relational index encompassing eight factors: cooperation, organizational culture, risk, trust, good faith, flexibility, the use of alternative dispute resolution, and contract duration. Using a 7-point likert scale, practitioners in the construction industry rated the degree that the different factors affected business relationships in different project contracts. The degree of relationalism is then calculated, after applying different weights to the factors using the Analytical Heirarchy Process (AHP), where a higher degree would correspond to a closer relationship between the parties and a more relational contract.

Aapaoja et al. (2013) analyzed the level of team integration in IPD projects. They identified twelve characteristics of an integrated project team almost identical to those of Baiden et al. (2006) with one added dimension: mutually beneficial results and innovations. In order to study the integration level, each characteristic is rated according to its level of achievement (on a specific project) using a 5-point likert scale. Their study did not provide one overall metric corresponding to the level of team integration.

Ibrahim et al. (2013) developed a conceptual team integration performance index for alliance projects. The study identified seven key indicators (KIs) for measuring team integration practices: team leadership, trust and respect, a single team focus on project objectives and key result areas, collective understanding, commitment from project alliance board, creation of single and co-located alliance team, and free flow communication. Based on the identified KPIs and their relative significance, a unified conceptual integration performance index was created. The weight of each factor was set according to its

respective importance as rated in surveys sent to experts with experience in alliance projects.

Harper (2014) attempted to measure project integration as a function of contractual relationships, using contractual norms. To elaborate, the author considered that project integration is based on relational contracting foundations and thus can be measured in terms of certain contractual norms. The norms considered are: role integrity, reciprocity, flexibility, contractual solidarity, reliance and expectations, restraint of power, proprietary of means, and harmonization of conflict. For each contractual norm, the author generated a number of statement items which were rated based on a 5-point likert scale ranging from strongly agree to strongly disagree. The study then employed complex statistical exploration and factor analysis in order to finally generate a measure of organizational integration.

2.5.3. Measuring SPV Integration and Shortcomings of Past Research

On PPP projects, the SPV is directly responsible for controlling and achieving integration. According to Gruneberg and Hughes (2004), the SPV consortium, despite presenting the impression of team working, may be just as fragmented as parties under traditional procurement methods. Therefore, the level of stakeholder integration in the SPV is a direct result of the measures the former adopts in order to achieve integration. These measures relate to the foundations of project delivery discussed previously, as a function of the organization structures, contractual frameworks, operating systems, and processes that the SPV puts in place. Therefore, the optimal perspective for measuring SPV integration is based on considering a holistic investigation of the SPV's adopted measures.

The research reviewed above shows that different tools and perspectives have been used in investigating project stakeholder integration. Some researchers have correlated the

degree of integration to the quality and quantity of organizational interactions while others have based their quantification on different integration factors. Of the latter, most have focused on the contractual basis driving project integration. However, literature on integration lacks studies that investigate integration on PPP projects in general, and within the SPV organization in specific. Additionally, none of the investigated studies have attempted to study integration from a holistic integrated project delivery perspective, in terms of the three delivery system's foundations: organization structures, commercial terms, and operating systems.

CHAPTER 3
RESEARCH MOTIVATION AND OBJECTIVES

This chapter presents the formal point of departure of this research, stemming from the previously reviewed literature. This is followed by the developed research objectives and questions.

3.1. Formal Point of Departure

The previously explored literature and studies reveal that there is a need to investigate and evaluate the management role of the SPV, specifically in terms of effective stakeholder integration, as it is both a prerequisite and a driver for PPP project success. Stakeholder integration appears to be a central foundation of SPV project delivery, as it is a function of the SPV structure and the PPP procurement route together. Considering the significance of stakeholder integration for the SPV and thus its connection to the IPD system, added to the fact that the IPD field is rich with research on integration, there is an opportunity for projecting IPD concepts onto the SPV evaluation framework. Based on a thorough review of the literature, no studies to date have attempted to evaluate the SPV's stakeholder management role, let alone study SPV integration based on IPD foundations. In addition, as previously discussed, no studies in general have based their measurement of project integration on a holistic perspective of integration foundations, considering the procurement route's organization structures, contractual frameworks, and operating systems and processes. Therefore, this research attempts to investigate core SPV characteristics that describe its management functions and evaluate SPV stakeholder integration. The overall aim of this study is the development of a metrics, inspired by the IPD philosophy, to assess

SPV collaboration and subsequently integrate them into a tool to provide a measure of the overall SPV integration level. The proposed tool is further applied to a PPP airport project in the Middle East to investigate its SPV operations and identify shortfalls.

3.2. Research Objectives and Questions

3.2.1. Research Objectives and Strategies

Objective 1: Establish a thorough understanding of core SPV characteristics, stakeholder relationships, and management operations

Investigation of the literature has revealed that there is no clear interpretation of SPV internal relationships and interactions from a stakeholder management point of view. Additionally, a clear delineation of SPV characteristics and their relationship to the PPP procurement route is absent. Therefore, this objective attempts to provide a portrayal of these aspects through delivering a depiction of the core SPV features, as stemming from the nature of PPPs, that encourage stakeholder collaboration and integration. Further, through the investigated case study, the operations of the SPV and its management functions on real-life projects are described and analyzed. Specifically, the objective aims to identify: the major stakeholders involved in the SPV and their organizational structure, the types of interactions between the participants, the management entity involved, the decision-making methodology in the SPV, the coordination and management processes of the SPV, and major characteristics of the SPV on a PPP project.

Objective 2: Develop and test an "SPV Health-Check Tool" that measures the integration level of the SPV

Currently, there is no existing measure or indicator of SPV stakeholder integration. Therefore, a tool is developed with the goal of providing a measure of the integration level of the SPV, investigating if and how the foundations of the SPV delivery route within a

PPP project contribute to the integration level of the SPV stakeholders. Inspired by the correlation with the IPD system, we have decided to define integration from a holistic IPD perspective, along the delivery system's three foundations: organization structures, contractual frameworks, and operating systems and processes. Therefore, to construct the tool, factors of successful integration are identified, related to each of these three foundations, and are eventually used as input measures in the Health-Check tool to evaluate the outcome integration level of the SPV. The developed tool is tested on a real-life PPP project, the results analyzed, and conclusions drawn on that basis.

3.2.2. Research Questions

The following research questions serve as a guidance throughout this research for attaining the aforementioned objectives.

1. How does the SPV efficiently integrate its internal stakeholders to deliver a successful project?
2. What measures can be used to evaluate the SPV's integration level as an enabler of successful relationship management?

CHAPTER 4
RESEARCH METHODOLOGY AND METHODS

To answer the previously developed research questions, a stepwise methodology is designed, as depicted in Figure 4, to comprise the following major research tasks: 1) knowledge acquisition and background research; 2) establishing SPV characteristics; 3) developing SPV integration factors; 4) constructing the SPV integration tool; 5) applying the tool to a case study; and 6) analysis and discussion of results.

4.1. Knowledge Acquisition and Background Research

A thorough review of the available literature is the necessary starting point to acquire relevant knowledge on the topic, identify the research gaps, and set the research objectives and contributions accordingly. The review for this research tackled three main fronts: a) PPP projects and their features with a focus on the Special Purpose Vehicle, b) integrated project delivery and its foundations, and c) studies and measures of stakeholder integration on construction projects. The first front provided the required overview of the involved project parties, SPV functions in a PPP, and the contractual frameworks. More specifically, SPV stakeholder relationships and their management were investigated to reflect the significance of studying stakeholder collaboration and integration within the SPV. After establishing the link between SPV project delivery and integrated project delivery systems, a review of the principles of IPD was essential to provide a background to the proposed research. Finally, studies that attempted to measure stakeholder integration on construction projects were thoroughly explored, as they serve as the stepping point in

developing measuring factors of SPV integration and, ultimately, the proposed SPV integration tool.

4.2. Establishing SPV Characteristics

A review of the pertinent literature reflected that there is a lack of material concerning the SPV, its functions, operations, and relationships at the internal level. Further, there is no comprehensive grouping of the various characteristics of the SPV, particularly those that tie its delivery route to that of integrated project delivery systems, despite the inherent potential of the former to achieve integration. Therefore, the first objective of this research was to establish and describe key SPV integration characteristics, derived from features of PPPs, which promote stakeholder collaboration and link the SPV to integrated project delivery. This was achieved through reliance on the background literature and investigative studies on one hand, and through interviews with professionals with direct experience in the PPP industry on the other. The latter offered substantial input that helped bridge the academic gaps and provided additional feedback that was significant in pinpointing relationships between SPV characteristics and stakeholder integration.

4.3. Developing SPV Integration Factors

In order to construct the SPV integration tool, it was first necessary to define the tool's input factors that serve as measures of the different aspects of integration in the SPV. In this research, inspired by the correlation with the IPD system, the established integration factors are defined along the delivery system's three foundations: organization structures, contractual frameworks, and operating systems and processes. These factors are developed along three phases. The first phase consists of identifying applicable factors from previous studies that have recognized measures of stakeholder integration generally. The second

phase involves deriving additional factors based on principles of integrated project delivery systems. The final step entails filtering and grouping the above identified factors in terms compatible with the SPV delivery structure, and lastly sorting them under the three headings of organization structures, contractual frameworks, and operating systems and processes.

4.4. Constructing the SPV Integration Tool

After identifying the various factors that measure stakeholder integration, the next step is constructing the SPV integration tool. As different factors may contribute differently to the overall level of stakeholder integration, depending on each factor's relative importance, it is essential to apply different coefficients to each factor as necessary. The coefficients would describe the significance of respective measures: the higher the former, the higher the degree of influence of the latter factor on the project integration level. To rank the numerous factors, a survey was constructed and addressed to professionals experienced in various forms of integrative project delivery, including working in consortia, joint ventures, partnerships, PPPs, and IPD projects. The survey respondents rated the factors utilizing the Analytical Hierarchy Process (AHP), which involves ranking the factors using a pair-wise comparison methodology in terms of the relative importance of each factor over the other in contributing to the overall level of stakeholder integration on a project. The final result is a comprehensive tool, formed of measuring factors with different degrees of significance, which calculates the overall achieved integration level within the SPV.

4.5. Case Study: Application, Analysis, and Conclusions

The developed tool is finally applied and tested on a PPP case study to investigate the SPV's management success in terms of its achieved degree of integration. The case study involves a well-known PPP project in the Middle East and information is gathered through direct interviews with representatives of the different stakeholders involved within the project SPV. Facts on the SPV's organizational structures, contractual frameworks, and operating systems and processes on this specific project is gathered through discussions with key senior personnel from the project management entity, the SPV Contractor, and the SPV Operator. After forming a solid understanding of the project background, a self-assessment is conducted, rating the degree of achievement of the different factors as substantiated by the gathered facts. The self-assessment serves to preserve the objectivity of the case study and avoid sensitive issues arising between the different interviewed parties. The results of this case study contribute towards both the first research objective in providing information on the SPV's operations and clarifying the its management mechanisms on real-life projects, and towards the second research objective by serving as a model for the application of the developed tool to measure the project integration level. Finally, the outcomes are analyzed and conclusions given in terms of recommendations and lessons learned.

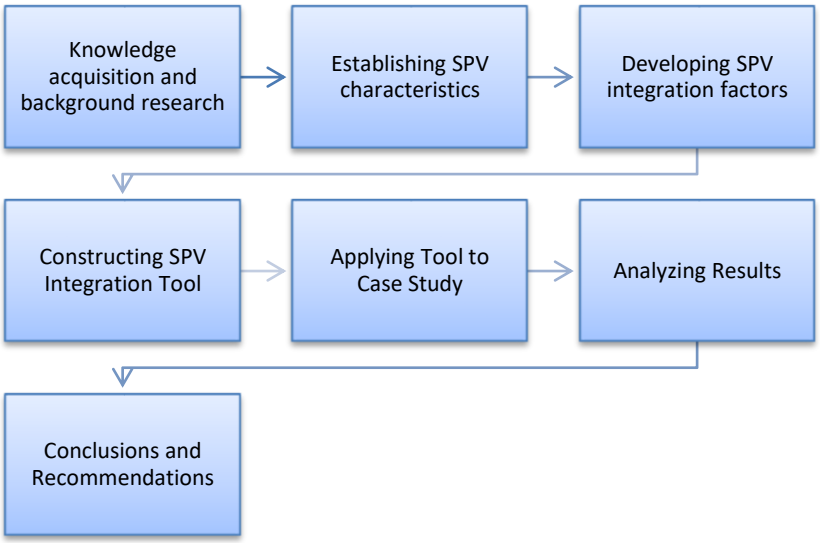


Figure 4: Research Methodology

CHAPTER 5
IDENTIFYING SPV INTEGRATION CHARACTERISTICS

Being a distinct procurement route, PPPs are characterized by several features that differentiate them from traditionally procured projects. Some of these are: uncertainties and risks stemming from the long-term agreements, major rearrangements in the roles of the multiple project stakeholders, increased responsibilities and risks for the private sector, and complex contractual arrangements between different stakeholders (Zhang, 2005). No study seems to have generated a formal list of PPP and SPV features and characteristics, as they seem to be scattered in the literature. After a thorough investigation of the literature, we were able to generate a number of SPV characteristics that promote stakeholder collaboration and integration, and correlate them to PPP features, as presented in this chapter. Figure 5, at the end of the chapter, delineates the generated characteristics and their relationships.

5.1. Alignment of Stakeholder Goals and Interests

The SPV, as an organization, is formed specially to undertake the PPP project; it does not exist either before project award or after contract completion (Chowdhury et al, 2011). Therefore, this entity could be described as being "customized" for the project itself. The SPV design, which is a function of the both the contractual schemes and the organizational structure, enables better alignment of stakeholder interests (Sainati et al, 2017).

The primary motivation behind this alignment of interests is that the major stakeholders, who are the DB contractor and O&M contractor, are traditionally equity shareholders in the SPV. This approach necessitates that contractors and service providers sponsor the SPV and take stakes in it as a sign of committing to the PPP project. The initial organization and bidding process would be directed by the engineering and construction contractors and facility operators primarily, in addition to the third party investors and lenders (Grimsey and Lewis, 2004). In fact, article IX of the Lebanese PPP Law states that "the Private Partner shall not have the right to relinquish its shares in the Project Company before the project reaches the operational stage" (Republic of Lebanon Parliament, 2017). This serves to ensure that the SPV contractors remain involved in the financing as long as possible in order to maintain their commitment to the project.

Involving the contractors in project funding is equivalent to strengthening their association with the project. This generates a connectivity between project funders and service providers, and bridges the gap between them. In addition, as the SPV is to operate the project for a long period of time after construction, it would be acting as a quasi-project-owner during that period. Consequently, the roles of "project owner", "project contractor", and "project operator" become integrated, within the SPV structure. This would instigate the SPV to consider what is best for the project during the design and construction stages, as it bears the resulting consequences throughout project operation. Additionally, as all the major stakeholders on the project are incorporated under the umbrella of this SPV and deliver the project as one unified body, an environment of joint responsibility and shared risk management is created. This not only causes the alignment of interests between the different key stakeholders, but also causes their alignment with the overall project interests, which is even of greater importance.

5.2. Whole-life Cycle Approach

PPP projects are characterized by the SPV stakeholders taking a whole-life cycle perspective of the project. This is a function of three main features: designing for service delivery, bundling project functions, and long term contracts.

5.2.1. Design for Service Delivery

PPP projects encompass a feature that goes past the mere delivery of an asset, but rather focuses on the delivery of a continuous service (Grimsey and Lewis, 2004; World Bank, 2009). The main distinction that characterizes service delivery performance is its requirement for considering serviceability issues in the design phase of the project, since this initial phase affects all the consequent phases, primarily in terms of costs (Tranfield et al, 2005). Therefore, the SPV, in designing for the delivery of the required service, would adopt whole-life cycle costing.

5.2.2. Bundling Project Functions

A main feature of PPPs is the bundling of major project phases or functions (World Bank, 2017). This refers to the combination of the design, construction, and operations and maintenance stages in specific. This bundling encourages the SPV to consider implications of its decisions on different stages of the project which leads to the adoption of whole-life cycle costing (Chan and Cheung, 2014; World Bank, 2009). To elaborate, the integration of project functions in an award to one unified project company provides this company with financial motivation to think beyond the design stage and incorporate energy-reducing and waste-minimizing features that may have higher initial costs but lower overall operational costs. In other words, the private party will work on optimizing trade-offs between the initial investment costs and future operations and

maintenance costs, as it is involved in all project phases. This cost effectiveness is a consequence of both the upfront engineering of design and the downstream management of project delivery (Grimsey and Lewis, 2004). Therefore, the optimization of costs is happening at the overall project level instead of the individual phase levels. In lean terms, this is a shift from the traditional concept of transformation and local optimization to the global perspective of flow and value generation.

5.2.3. Long Term Contracts

PPP projects are characterized by the long-term nature of their contracts. These long term commitments act as incentives for the private party to account for service delivery cost when designing the project. A long-term contract generates a longer term commitment, which places capital at risk and is presumed to force the private stakeholders to produce a facility that is durable and functional while minimizing life cycle costs (Leiringer, 2006). Therefore, the SPV adopts a "whole-life" approach, considering the life-cycle costs and benefits of the project, which maximizes the efficiency of service delivery (World Bank, 2017).

5.3. Collaborative Environments

PPPs are regarding as creating collaborative environments which instigate team working, collective decision making, and cross-functional information sharing. These environments stem from several aspects of a PPP project, mainly the early involvement of stakeholders, design for service delivery, and the organization structure of the SPV.

5.3.1. Early Stakeholder Involvement

One distinctive feature of PPP projects is the early involvement of all key stakeholders in project delivery. In other words, from day one, the designer, constructor, and operator, are all on board in the SPV. Involving participants early on has been associated with a number of advantages. For instance, it allows for synthesis in planning the design and implementation stages, as their separation has proven to significantly reduce the potential of enhancing project performance (Fischbacher and Beaumont, 2003). This permits the provision of input by downstream participants into upstream design and construction stages. In addition, this removes organizational barriers to facilitate the flow of information across boundaries, cross-organizational thinking, and collective problem solving. Moreover, through efficient inclusion, it is possible to develop a series of partnership benefits that include generating a holistic approach that improves service quality, encouraging innovation and creativity, and enhancing organizational learning through knowledge transfer (Fischbacher and Beaumont, 2003; Leiringer, 2006).

5.3.2. Design for Service Delivery and SPV Structure

Designing for service delivery necessitates high levels of team working, communication, and collaboration throughout the project, in order to optimize the continuous provision of services. PPP project success is highly dependent on the quality of integration and collaboration within the SPV organization. The structure of the SPV is characterized by involving the major project stakeholders under one umbrella. It is designed, in concept, to foster such integrative and cooperative efforts across the different teams involved to deliver successful outcomes.

5.4. Potential for Innovation

One of the most cited features of PPPs is their potential for innovation. Innovation can refer to both products and processes through either introducing a new product, or improving upon a certain process (Leiringer, 2006). Innovation has been said to provide various benefits to the project, including efficiency improvement and value enhancement (Tawiah and Russell, 2008). Both the UK and the Swedish governments consider that PPPs encourage private parties to be innovative and try out new ideas to deliver projects with better value (Leiringer, 2006). Therefore, it is interesting to investigate how PPP projects promote this notion.

Research conducted on the relationship between project procurement mode and innovation potential concluded that this relationship is in fact strong. This innovation potential is influenced by certain aspects of the procurement system, such as the project requirements, specifications, and constraints (Tawiah and Russell, 2008). In addition, studies also found that improved inter-organizational cooperation of the involved project stakeholders has the potential of leading to successful innovation (Eaton et al, 2006). Consequently, PPPs seem to be a fertile ground to harvest innovation on two levels: (1) design freedom through output specifications and (2) collaborative environments.

5.4.1. Design Freedom: Output Specifications

The scope of services of the SPV in PPP projects is provided in the form of output specifications and service level agreements, which define guidelines for service delivery, and are often combined with minimal technical requirements (Gomez and Gambo, 2016; Grimsey and Lewis, 2004; Leiringer, 2006). Providing output based specifications in PPP contracts has one main effect: it offers the private party a degree of freedom to design innovative cost-effective solutions for service delivery (World Bank, 2009). It also offers

the private party the liberty to perform operations in a manner that best suits its expertise. The private sector has the opportunity to utilize its skills and experience in order to create solutions that optimally serve the public sector's requirements.

5.4.2. Collaborative Working

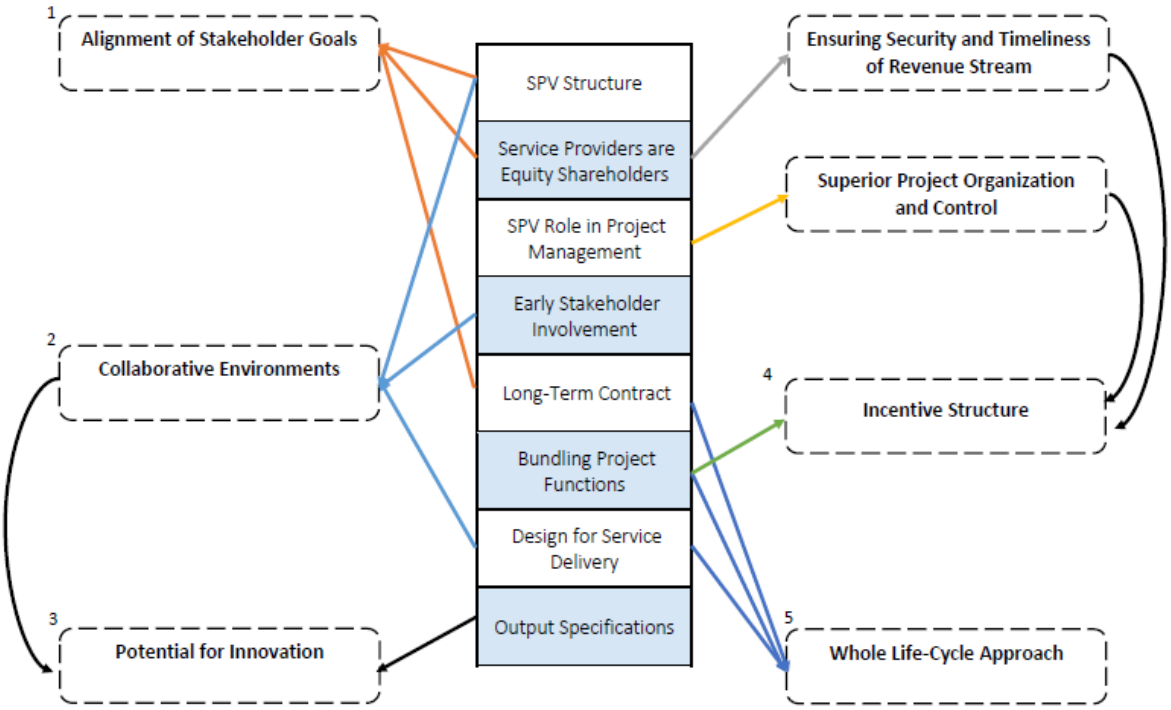
Another main driver of innovation in PPP projects is the environment based on collaborative working. As previously explained, this environment facilitates inter-organizational communication and information flow between the different SPV stakeholders. Therefore, this enhanced communication is thought to enable innovative behavior (Leiringer, 2006).

5.5. Incentive Structure

The fundamental theory underlying the complex PPP arrangements revolves around a single simple notion: incentives. These incentives are actually inbuilt into the PPP delivery system, risk transfer models, and contractual frameworks. Some of these have been discussed before in the previous characteristics. For example, giving the SPV the responsibility to design, construct, operate, and maintain the facility encourages it to (1) consider constructability aspects in the design, (2) consider construction costs in the design, (3) reduce any possibility of skimping on material quality as it will later bear the consequences, (4) explore innovations that can enhance quality and reduce operations and maintenance costs, and (5) deliver the facility and service with an overall holistic approach that is built on global optimization.

Moreover, giving this same entity the extra role of construction and project management creates an incentive to maintain superior project organization and control, ensure the project is on track, and avoid cost overruns and construction delays.

Finally, giving the SPV the responsibility for additionally financing the project forces it to provide better management to minimize the risk of project failure, in order to ensure the security and timeliness of the revenue stream (Grimsey and Lewis, 2004).



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2. Fischbacher and Beaumont, 2003; Leiringer, 2006.

3. Eaton et al., 2006; Gomez and Gambo, 2016; Grimsey and Lewis, 2004; Leiringer, 2006; Tawiah and Russell, 2008; World Bank, 2009.

4. Grimsey and Lewis, 2004.

5. Chan and Cheung, 2014; Grimsey and Lewis, 2004; Leiringer, 2006; Tranfield et al., 2005; World Bank, 2009; World Bank, 2017.

Figure 5: Links between SPV Characteristics and PPP Features

CHAPTER 6
DEVELOPING THE SPV HEALTH-CHECK TOOL

This chapter presents the methods used to generate success factors for measuring integration and to build the SPV Health-Check Tool. The aforementioned factors serve as input measures in the developed tool and are rated in degree of importance through a survey addressed to industry professionals. The final tool – constructed and calibrated using the Analytic Hierarchy Process (AHP) – is portrayed.

6.1. Methodology for Developing Factors

As previously concluded, no framework exists that attempts to evaluate SPV relationship management success or measure its stakeholder integration level. In addition, of the frameworks available in the literature that investigate stakeholder integration, none seem to do so from a holistic IPD perspective, in terms of the foundations of the procurement system itself. As our research has established a correlation between SPV procurement and the IPD system, the established integration factors are defined along the delivery system's three foundations: organization structures, contractual frameworks, and operating systems and processes. Therefore, in order to develop factors for our tool in specific, a certain three-phase methodology was followed.

First, a thorough literature review is conducted of previous studies that have attempted to measure project stakeholder integration or related concepts. A number of relevant factors is henceforth identified from these studies, dealing with the topics of project and stakeholder integration, principles of relational contracting, and concepts of

SPV functions in PPP project delivery. In total, 30 factors were identified, as presented in Table A1 in Appendix A.

The second phase consisted of deriving additional factors based on philosophies of integrated project delivery. Although a plethora of studies that deal with principles of integrated project delivery systems exist, these studies do not identify actual measurable factors that appraise the degree of stakeholder integration from a holistic perspective. Therefore, in order to reflect the core values of integrated project delivery in the developed SPV Health-Check tool, factors are developed based on the fundamental principles of stakeholder integration philosophy, inspired from approaches such as IPD and PA. These were inspired primarily from the American Institute of Architects (AIA) guide to Integrated Project Delivery (AIA, 2007), but also relied on other sources detailing IPD values (El-adaway et al., 2017; Thomsen et al., 2009). In total, 20 factors were developed, as presented in Table A2 in Appendix A.

The final step consisted of filtering, grouping, and sorting the above identified factors under the three headings. Filtering involves eliminating some factors that do not apply in our tool. For example, “innovation and improvement” and “effective management of health and safety” serve as outcome indicators of integration instead of input measures that contribute to integration, and are therefore eliminated. Grouping entails gathering similar or redundant factors under a single heading. For example, “using an integrated ICT system” is enveloped under “using appropriate technology”. Finally, the factors are expressed in terms compatible with the SPV delivery structure, and sorted under the three headings of organization structures, contractual frameworks, and operating systems and processes.

6.2. Final Developed Factors for Measuring SPV Integration

6.2.1. Success Factors for Organization Structures

The first set of factors belongs to the organization structures grouping and therefore presents the structural requirements for successful stakeholder integration. These mostly relate to team formation, organization, and compatibility on the project. In total, 12 factors were identified under this heading. These factors, along with their respective descriptions, are presented in Table 1 below.

Table 1: Factors under Organization Structures

No	Factor	Description
1	Creation of a single integrated team	Establishing a common platform for the different stakeholder teams.
2	Team is co-located	Team is co-located in the same work environment; facilitates increased, unrestrained and continuous communication and interaction.
3	Early involvement of key participants	Involving key participants early on to receive influential input during the early project stages of decision making.
4	Equitable team relationships and opportunities for project input	There is a balance of power and influence among the different stakeholders; all parties have an opportunity for suggesting input and an involvement in decision making.
5	Creation of an integrated project management group	The core group is made up of representatives of key project stakeholders and is responsible overall project governance.
6	Creation of a multidisciplinary group responsible for relationship management	This group is responsible for coordinating stakeholder relationships and interactions.
7	Qualified organization and leadership	Organization and leadership is dedicated to qualified and competent people.
8	Previous experience in partnering approaches	Previous experience of the individual teams in PPP project delivery, relational contracting, integrated project delivery, and/or similar partnering approaches.

9	Previous history of teams	Previous positive working relationships among the parties.
10	Compatibility of stakeholder teams	Compatible organizational culture of the involved parties.
11	Harmonious inter-personal relationships	Harmonious relationships on the individual level.
12	Participation of top management	Direct and indirect participation of the highest level of management to provide the required support and resources for relationship management.

6.2.2. Success Factors for Contractual Frameworks

The second set of factors is related to the contractual framework of the stakeholders. They represent certain contractual issues that must be taken into perspective to ensure efficient integration. This is not only limited to commercial terms but also encompasses risk management and legal issues. In total, 7 factors were identified under this heading. These factors along with their respective descriptions are presented in Table 2 below.

Table 2: Factors under Commercial Frameworks

No	Factor	Description
1	Presence of a multiparty agreement	Ties project participants together and maximizes collaboration and project goals.
2	Pain sharing and gain sharing	Parties collectively share the overall benefits of project cost savings and the risk of cost overruns.
3	Collective management and sharing of risks	Risk identification, assessment, and management is a responsibility of all team members.
4	Compensation incentives	Methods of compensation that tie the participant's success to the overall success of the project.
5	Withdrawal is discouraged	Withdrawal of team members, whether through assignment or voluntary termination, is highly discouraged.

6	Waiver of claims	Organizations privy to the multi-party agreement waive claims against each other except for willful misconduct, fraud, or gross negligence.
7	Internal dispute resolution	Internal disputes are resolved by the project's decision-making body, which makes decisions unanimously in the best interest of the project.

6.2.3. Success Factors for Operating Systems and Processes

The last set of factors is related to the operating systems and processes employed on a project. As previously discussed, operating systems should make way for the openness and transparency required by the integrated project delivery system. Project processes, on the other hand, describe certain practices and mechanisms required to maintain successful team integration. Overall, this grouping relates to the systems used and the day-to-day operations on the project. Also, it encompasses aspects related to the project culture. In total, 11 factors were identified under this heading. They are presented, along with their respective descriptions, in Table 3 below.

Table 3: Factors under Operating Systems and Processes

No	Factor	Description
1	Using appropriate technology	Technology that is compliant with open standards is used to facilitate communication and collaboration among participants.
2	Using an integrated design sharing platform	E.g. BIM provides a platform for collaboration throughout the project's design, construction, operations, and maintenance phases.
3	Collective generation of a single team focus and objectives	In integrated projects, a team of representatives from the key organizations meets early in the project development process to discuss and agree to appropriate project goals.
4	Collaborative decision making	All decisions are made unanimously by a defined decision making body in the best interest of the project.

5	Unrestricted cross-sharing of information	Project design information needs to be accessible and available to all team members.
6	Accounting documents open to all members	Financial records should be accessible to all team members to ensure transparency.
7	Open communication	A culture built on open communications between the different stakeholder teams; unhindered by procedural formalities and protocols.
8	Collaborative planning	Involving all key participants in the planning process.
9	Collaborative project management and control	There is joint coordination and monitoring of works among the different stakeholders.
10	Creation of a no-blame culture	Responsibilities are clearly defined in a no-blame culture leading to identification and resolution of problems, not determination of liability.
11	Team commitment and attitudes	Attitudes of commitment, honesty, openness, trust, fairness, loyalty, receptivity, and care between the different stakeholder teams.

6.3. Developing the Health Check Tool Using the Analytic Hierarchy Process (AHP)

6.3.1. The Analytical Hierarchy Process: Overview and Methodology

It is logical to assume that the identified factors do not all contribute equally to the level of integration on a project. In fact, some factors may have more weight than others do, which implies that they would have a greater effect on stakeholder integration. Accordingly, this should be reflected in the tool calculating the level of integration, by using an appropriate statistical method.

The Analytic Hierarchy Process (AHP) presents itself as an apt technique to use in building the tool for this research. It is described as a multiple-criteria decision-making process that is used to set priorities among different criteria (Alharthi et al., 2015). To elaborate, AHP evaluates weights, rankings, or importance of a set on factors according to their impact on the overall factor being analyzed. This method is chiefly beneficial in evaluating settings involving multiple factors, especially when these factors are expressed

in the form of a hierarchy. The theory of AHP is based on the principle that decision-making is greatly influenced by the knowledge and experience of the people involved (Vargas, 1990). Therefore, it relies on the subjective input of professionals in comparing the significance of the different criteria under study, in order to assign relative weights to those criteria.

The method has proven to be theoretically sound, and consequently has received widespread acceptance. Its success is reflected through its almost universal adoption, ease of implementation, and simplicity of understanding. Moreover, it has demonstrated the capability of producing results that agree with perceptions and expectations (Bhushan and Rai, 2007). The AHP has witnessed an extensive variety of applications in different fields. Examples of these are economics and planning, material handling and purchasing, project selection, budget allocation, methodology development, and consulting (Zahedi, 1986). Therefore, this research adopts the AHP as the methodology for rating the adopted factors and constructing the final tool.

Applying AHP requires three basic steps (Alharthi et al., 2015; Saaty, 1991):

1. The problem at hand is structured into a hierarchy of sub-problems. This is built by working downwards with the overall goal at the top, to criteria contributing to that goal in the second level, to sub-criteria in the third level, and so on.
2. Data is collected based on pair-wise comparisons of the different factors, in terms of the relative importance of one factor over the other in contributing to the element in the level above. The scale of comparison utilized ranges from 1 to 9, “1” meaning that the two factors are of equal importance, and “9” that one factor is absolutely more important than the other;
3. Statistical analysis is conducted to calculate the priority weights of the different factors. The higher the weight of the factor, the more it contributes to the final objective.

6.3.2. Building the AHP Factors Hierarchy

In order to apply AHP in our research, the problem had to first be structured as a hierarchy. In our case, the final objective is calculating the degree of integration. Therefore, the goal, which is represented in the first level of the hierarchy, is “stakeholder integration”.

The second level of the hierarchy encompasses the three main headings we have identified as foundations to stakeholder integration: organization structures, contractual frameworks, and operating systems. Under these, the various identified factors are organized and grouped into sub-criteria of different levels. The overall hierarchy, including first three levels is expressed in Figure 6. A more detailed hierarchy for each main heading, reaching level four, is shown in Figures 7, 8, and 9 below.

The presence of a large number of factors in our case makes it cumbersome to apply the AHP for the entire set of factors, the reason being the large number of comparisons that will be required. Therefore, the AHP will be applied to the first three levels in the hierarchy, as expressed in Figure 6. For the lower level (level 4), the factors will be assumed to carry the same weight.

Figure 6: Stakeholder Integration Factors Hierarchy (Levels 1 to 3)

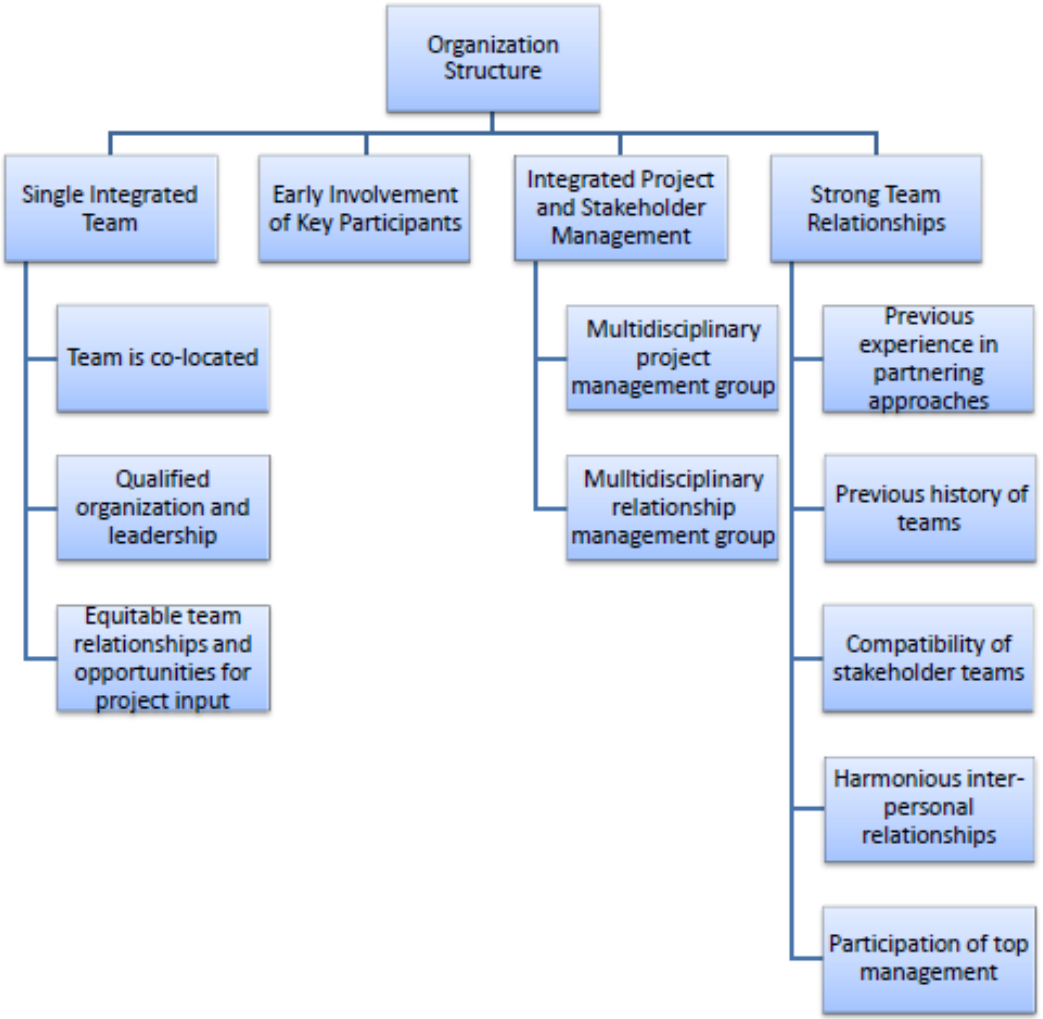

Figure 7: Organization Structures Hierarchy (Levels 2 to 4)

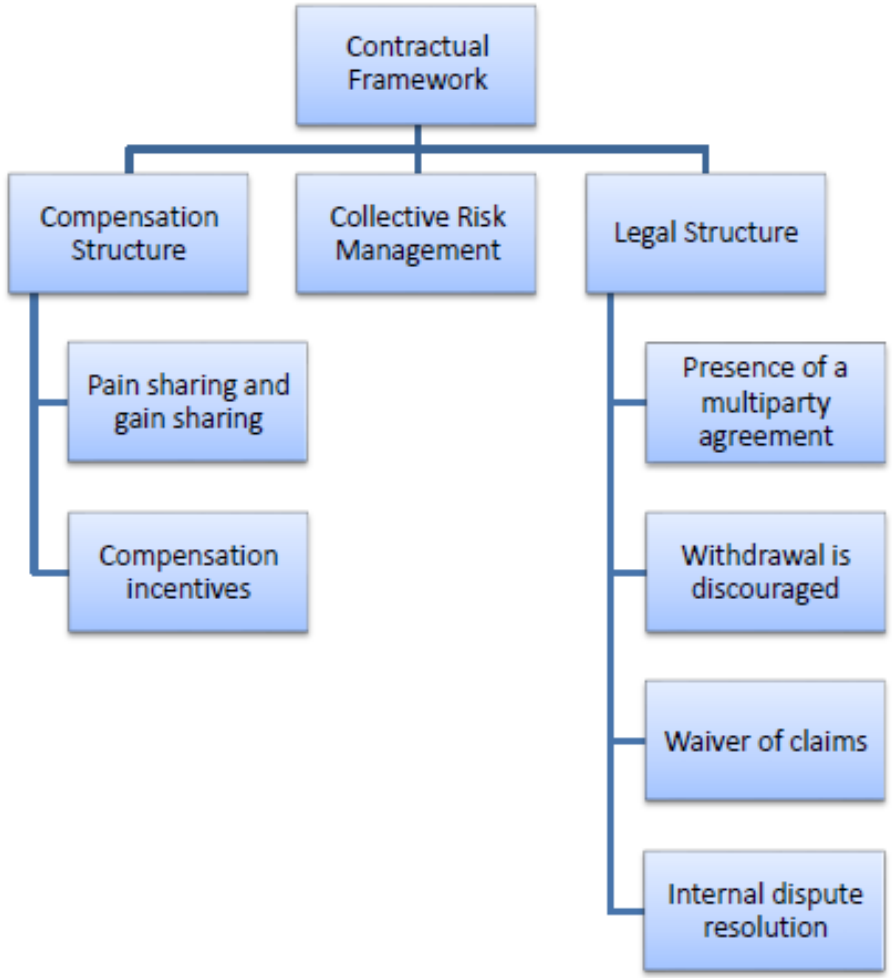

Figure 8: Contractual Frameworks Hierarchy (Levels 2 to 4)

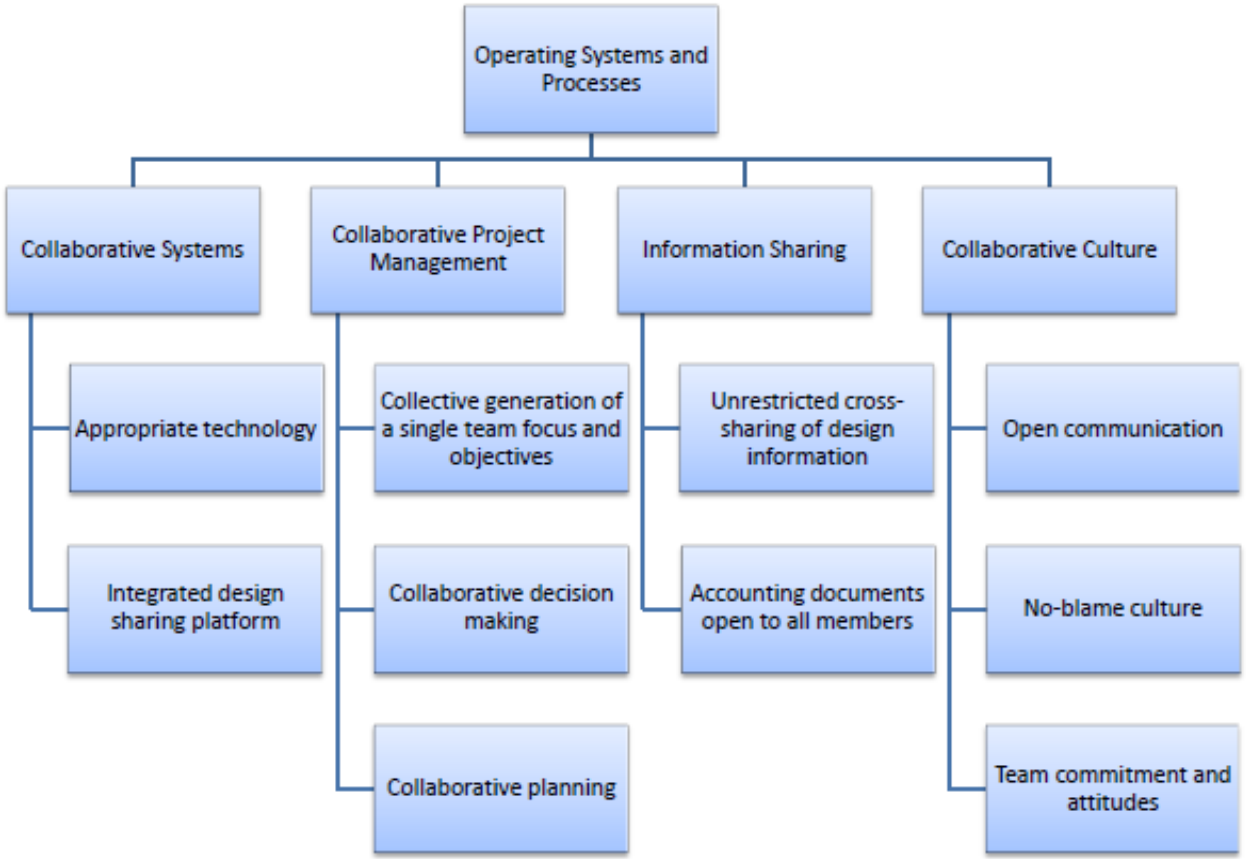

Figure 9: Operating Systems and Processes Hierarchy (Levels 2 to 4)

Table 4 below presents the different factors, classified as per their respective grouping and their level under the hierarchy. Each factor is assigned a specific identification code to facilitate its use in the formulae presented later.

Table 4: List of Factors under the Hierarchy

Level 1	Stakeholder Integration					
Level 2	*O*	Organization Structures	*C*	Contractual Frameworks	*P*	Operating Systems and Processes
Level 3	*O1*	Single integrated team	*C1*	Compensation Structure	*P1*	Collaborative Systems
	O2	Early involvement of key participants	*C2*	Collective Risk Management	*P2*	Collaborative Project Management
	O3	Integrated project and stakeholder management	*C3*	Legal Structure	*P3*	Information Sharing
	O4	Strong Team Relationships			*P4*	Collaborative Culture
Level 4	*O1a*	Team is co-located	*C1a*	Pain sharing and gain sharing	*P1a*	Appropriate technology
	O1b	Qualified organization and leadership	*C1b*	Compensation incentives	*P1b*	Integrated design sharing platform
	O1c	Equitable team relationships and opportunities for project input	*C2*	Collective risk management	*P2a*	Collective generation of a single team focus and objectives
	O2	Early involvement of key participants	*C3a*	Presence of a multiparty agreement	*P2b*	Collaborative decision making
	O3a	Multidisciplinary project management group	*C3b*	Withdrawal is discouraged	*P2c*	Collaborative planning

	O3b	Multidisciplinary relationship management group	*C3c*	Waiver of claims	*P3a*	Unrestricted cross-sharing of design information
	O4a	Previous experience in partnering approaches	*C3d*	Internal dispute resolution	*P3b*	Accounting documents open to all members
	O4b	Previous history of teams			*P4a*	Open communication
	O4c	Compatibility of stakeholder teams			*P4b*	No-blame culture
	O4d	Harmonious inter-personal relationships			*P4c*	Team commitment and attitudes
	O4e	Participation of top management				

6.3.3. AHP Survey Questionnaire: Design and Application

In order to generate representative coefficients pertaining to the significance of the various integration factors identified, a survey questionnaire was devised. The questionnaire was designed to collect feedback as input to the AHP to be utilized in constructing the final tool. Before addressing the said survey to the participants, a pilot survey was conveyed to three PPP industry practitioners to appraise the efficiency of the survey questions and reduce the possibility of inconsistent responses. Following their feedback, the survey was adjusted and uploaded on Lime Survey, an online survey tool, to be sent to eligible participants.

1) Background of Respondents

Since the information sought from the survey is specifically related to project delivery approaches embracing stakeholder integration, randomized sampling is deemed unsuitable for this study and purposive sampling is adopted (Babbie, 2013). Utilizing the latter, the authors judiciously selected practiced professionals who have experience with different types of collaborative approaches in project delivery. These include: partnering, working through a consortium, joint ventures, PA (Project Alliancing), and IPD (Integrated Project Delivery), among others. The targeted participants comprised a mixed group of regional and international professionals. For better reliability, the respondents were selected from a pool that contained various stakeholders in the construction industry, including: contracting, engineering, financing, governmental, and project management organizations.

The distribution of the participants is summarized in Table 5, which illustrates the nature of the respondents' organizations, their level of experience, and experience with project delivery approaches. The questionnaire was filled by 20 industry professionals, a total considered to present statistically representative results considering purposive sampling. The respondents are divided across a wide array of organizations and display considerable experience in different methods of collaborative

project delivery. Further, a large percentage (40%) of the participants have over 10 years of experience and therefore the quality of their feedback is considered noteworthy.

2) Structure of Survey

The survey is divided into two main sections. Prior to posing the questions, the survey begins with a research introduction providing a general overview, the survey goals, and a description of the survey structure. Additionally, important terms and concepts utilized in the survey are clarified. Section 1 gathers information on the background of the respondent (type of organization, years of experience, and experience with collaborative approaches in project delivery). Section 2, which forms the bulk of the survey, is where the different factors under levels 2 and 3 of the AHP hierarchy are compared. As previously described, this comparison process involves a pair-wise assessment of each factor against others of the same level in the hierarchy. The respective factors under each of the three identified headings (organization structures, contractual frameworks, operating systems and processes) are compared within their groupings (level 3). Finally, the afore three headings are also evaluated against each other (level 2). The scale used for comparison is as adopted by Saaty (1991) and presented in table 6 below. The full template of the survey is attached in Appendix B.

Table 5: Description of Survey Participants' Backgrounds

Nature of Respondent's Organization			**Respondent's Years of Experience**			**Type of Experience in Collaborative Project Delivery**		
Description	Number of Respondents	Percentage (%)	Description	Number of Respondents	Percentage (%)	Description	Number of Respondents	Percentage (%)
Employer/ Developer	2	10	0-5 years	2	10	Partnering	4	20
Financing Entity	3	15	5-10 years	10	50	Consortium	8	40
Design Consultant	1	5	>10 years	8	40	Joint Venture	7	35
Project Management Consultant	5	25				Project Alliance	0	0
Construction Contractor	6	30				Integrated Project Delivery	1	5
Government Entity/ Consultant	3	15						

Table 6: Saaty Scale for AHP Survey

Scale	Definition	Explanation
1	Equal importance	Equally-treated criteria
2	Slightly Equal	
3	Moderate Importance	Moderately favor one criteria over the other
4	Moderate plus	
5	Strong Importance	Strongly favor one criteria over the other
6	Strong plus	
7	Very Strong Importance	Very Strongly favor one criteria over the other
8	Very Strong plus	
9	Absolute Importance	Absolutely favor one criteria over the other

6.4. AHP Survey Results and Final Developed SPV Health Check Tool

A number of methods exist to calculate the coefficients that quantitatively represent the importance of each compared criterion relative to the goal. For this study, Microsoft Excel, equipped with a built-in AHP function, was utilized to undergo the analysis and generate the final coefficients. The results are presented in the tables and formulae below.

A) Results: Organization Structures Integration Level

After comparing the factors under level 3 of the hierarchy, as comprising the main headings under the “Organization Structures” grouping, the below coefficients are obtained (Table 7). Equation 1 presents the formula for calculating the integration level of the organization structure on the project. Equations 2 to 5 present complementing formulae to calculate the individual factors under level 4 of the hierarchy, which serve as input to Equation 1.

Table 7: Organization Structure Coefficients

Factor No.	Name	Coefficient (%)
O1	Single Integrated Team	24.7
O2	Early Involvement of Key Participants	25.1
O3	Integrated Project and Stakeholder Management	25.0
O4	Strong Team Relationships	25.2

Equation 1: Organization Structures Integration Level

$$Integration\ Level\ (O)\ = 0.247 \times O1 + 0.251 \times O2 + 0.250 \times O3 + 0.252 \times O4$$

Each of the factors O1, O2, O3, and O4, as belonging to the third level of the AHP hierarchy, are calculated as the average of their respective succeeding factors under level 4 of the hierarchy. The factors of level 4 are all assumed to carry an equal weight. The results are reflected in Tables 8 to 11 and Equations 2 to 5 below.

Table 8: Coefficients of Factors under O1 (Single Integrated Team)

Factor No.	Name	Coefficient (%)
O1a	Team is co-located	33.3
O1b	Qualified organization and leadership	33.3
O1c	Equitable team relationships and opportunities for project input	33.3

Equation 2: O1 Integration Level

$$\boldsymbol{O1 = 0.333 \times O1a + \ 0.333 \times O1b + \ 0.333 \times O1c}$$

Table 9: Coefficients of Factors under O2 (Early Involvement of Key Participants)

Factor No.	Name	Coefficient (%)
O2	Early involvement of key participants	100.0

Equation 3: O2 Integration Level

$$\boldsymbol{O2 = 1.0 \times O2}$$

Table 10: Coefficients of Factors under O3 (Integrated Project and Stakeholder Management)

Factor No.	Name	Coefficient (%)
O3a	Multidisciplinary project management group	50.0
O3b	Multidisciplinary relationship management group	50.0

Equation 4: O3 Integration Level

$$\boldsymbol{O3 = 0.5 \times O3a + 0.5 \times O3b}$$

Table 11: Coefficients of Factors under O4 (Strong Team Relationships)

Factor No.	Name	Coefficient (%)
O4a	Previous experience in partnering approaches	20.0
O4b	Previous history of teams	20.0
O4c	Compatibility of stakeholder teams	20.0
O4d	Harmonious inter-personal relationships	20.0
O4e	Participation of top management	20.0

Equation 5: O4 Integration Level

$$O4 = 0.2 \times O4a + 0.2 \times O4b + 0.2 \times O4c + 0.2 \times O4d + 0.2 \times O4e$$

B) Results: Contractual Frameworks Integration Level

Comparing the factors under level 3 of the hierarchy, as comprising the main headings under the "Contractual Frameworks" grouping resulted in the coefficients presented in Table 12 below. Equation 6 presents the formula for calculating the integration level of the contractual frameworks on the project. Equations 7 to 9 present complementing formulae to calculate the individual factors under level 4 of the hierarchy, which serve as input to Equation 6.

Table 12: Contractual Frameworks Coefficients

Factor No.	Name	Coefficient (%)
C1	Compensation Structure	56.1
C2	Collective Risk Management	22.3
C3	Legal Structure	21.6

Equation 6: Contractual Frameworks Integration Level

$$Integration\ Level\ (C) = 0.561 \times C1 + 0.223 \times C2 + 0.216 \times C3$$

Each of the factors C1, C2, and C3, as belonging to the third level of the AHP hierarchy, are calculated as the average of their respective succeeding factors under level 4 of the hierarchy. The factors of level 4 are all assumed to carry an equal weight. The results are reflected in Tables 13 to 15 and Equations 7 to 9 below.

Table 13: Coefficients of Factors under C1 (Compensation Structure)

Factor No.	Name	Coefficient (%)
C1a	Pain sharing and gain sharing	50.0
C1b	Compensation incentives	50.0

Equation 7: C1 Integration Level

$$C1 = 0.5 \times C1a + 0.5 \times C1b$$

Table 14: Coefficients of Factors under C2 (Collective Risk Management)

Factor No.	Name	Coefficient (%)
C2	Collective risk management	100.0

Equation 8: C2 Integration Level

$$C2 = 1.0 \times C2$$

Table 15: Coefficients of Factors under C3 (Legal Structure)

Factor No.	Name	Coefficient (%)
C3a	Presence of a multiparty agreement	25.0
C3b	Withdrawal is discouraged	25.0
C3c	Waiver of claims	25.0
C3d	Internal dispute resolution	25.0

Equation 9: C3 Integration Level

$$C3 = 0.25 \times C3a + 0.25 \times C3b + 0.25 \times C3c + 0.25 \times C3d$$

C) Results: Operating Systems and Processes Integration Level

Comparing the main headings under level 3 of the "Operating Systems and Processes" grouping resulted in the coefficients presented in Table 16 below. Equation 10 presents the formula for calculating the integration level of the operating systems and processes on the project. Equations 11 to 14 present complementing formulae to calculate the individual factors under level 4 of the hierarchy, which serve as input to Equation 10.

Table 16: Operating Systems and Processes Coefficients

Factor No.	Name	Coefficient (%)
P1	Collaborative Systems	13.5
P2	Collaborative Project Management	36.1
P3	Information Sharing	29.7
P4	Collaborative Culture	20.7

Equation 10: Operating Systems and Processes Integration Level

$$Integration\ Level\ (P)\ = 0.135 \times P1 + 0.361 \times P2 + 0.297 \times P3 + 0.207 \times P4$$

Each of the factors P1, P2, P3, and P4, as belonging to the third level of the AHP hierarchy, are calculated as the average of their respective succeeding factors under level 4 of the hierarchy. The factors of level 4 are all assumed to carry an equal weight. The results are reflected in Tables 17 to 20 and Equations 11 to 14 below.

Table 17: Coefficients of Factors under P1 (Collaborative Systems)

Factor No.	Name	Coefficient (%)
P1a	Appropriate technology	50.0
P1b	Integrated design sharing platform	50.0

Equation 11: P1 Integration Level

$$P1 = 0.5 \times P1a + 0.5 \times P1b$$

Table 18: Coefficients of Factors under P2 (Collaborative Project Management)

Factor No.	Name	Coefficient (%)
P2a	Collective generation of a single team focus and objectives	33.3
P2b	Collaborative decision making	33.3
P2c	Collaborative planning	33.3

Equation 12: P2 Integration Level

$$P2 = 0.333 \times P2a + 0.333 \times P2b + 0.333 \times P2c$$

Table 19: Coefficients of Factors under P3 (Information Sharing)

Factor No.	Name	Coefficient (%)
P3a	Unrestricted cross-sharing of design information	50.0
P3b	Accounting documents open to all members	50.0

Equation 13: P3 Integration Level

$$P3 = 0.5 \times P3a + 0.5 \times P3b$$

Table 20: Coefficients of Factors under P4 (Collaborative Culture)

Factor No.	Name	Coefficient (%)
P4a	Open communication	33.3
P4b	No-blame culture	33.3
P4c	Team commitment and attitudes	33.3

Equation 14: P4 Integration Level

$$P4 = 0.333 \times P4a + 0.333 \times P4b + 0.333 \times P4c$$

D) Overall Integration Level: Results and Formulae

Finally, after comparing the factors under level 2 of the hierarchy, which comprise the three main groupings (organization structures, contractual frameworks, and operating systems and processes), the obtained coefficients are presented in Table 21 below. Equation 15 displays the formula for calculating the overall project integration level.

Table 21: Overall Integration Factors Coefficients

Factor No.	Name	Coefficient (%)
O	Organization Structures	37.3
C	Contractual Frameworks	43.2
P	Operating Systems and Processes	19.5

Equation 15: Overall Project Integration Level

$$Overall\ Project\ Integration\ Level = 0.373 \times O + 0.432 \times C + 0.195 \times P$$

$$= 0.373 \times (0.247 \times O1 + 0.251 \times O2 + 0.250 \times O3 + 0.252 \times O4) + 0.432 \times (0.561 \times C1 + 0.223 \times C2 + 0.216 \times C3) + 0.195 \times (0.135 \times P1 + 0.361 \times P2 + 0.297 \times P3 + 0.207 \times P4)$$

6.5. AHP Survey Results: Discussion and Analysis

6.5.1. Consensus Analysis

A noteworthy element to consider when studying the AHP results is the degree of consensus between the AHP survey participants as it carries an indication of the reliability and significance of the resultant ratings. Figure 10 below delineates the percentage of consensus between the participants when rating the different factors under

the designed groupings. As indicated in the figure, the percentage of consensus in the different groupings ranges from 63.2% to 70.5%. This range is considered satisfactory and thus the results prove representative for use in the overall integration equation.

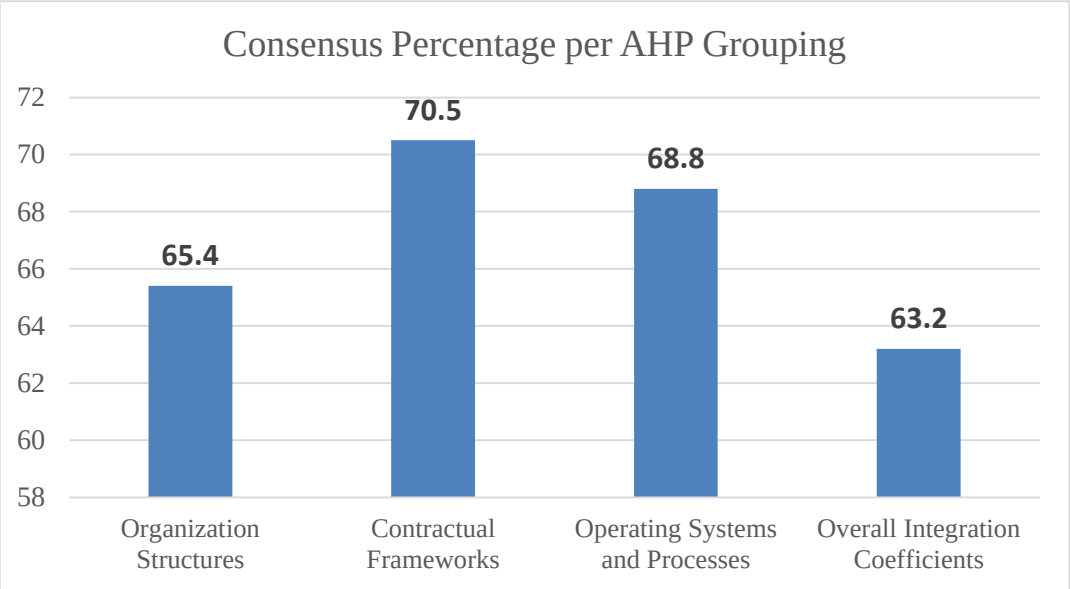

Figure 10: Consensus Analysis of AHP Responses

6.5.2. Relative Significance of the Overall Integration Foundations

The results reflected in Table 21 show that out of the three integration foundations, the contractual frameworks have the most contribution towards the stakeholder integration level on the project (43.2%). These are followed by the organization structures, which received a similarly comparable level of importance (37.3%). On the other hand, the operating systems and processes used on the project do not seem to contribute as much to the level of stakeholder integration, having a lesser importance of 19.5%

In analyzing the afore results, it is not surprising that the contractual structure on the project has the primary effect in achieving stakeholder integration – the chief reason being that the former comprises both the compensation and legal functions on the project. The project stakeholders are therefore most motivated by the conditions of payment, the risk management approach, and the legal terms that they are contractually

bound by. The organization structures formed on the project also contribute significantly to the stakeholder integration level. The formation of unified working teams and integrated management groups, added to the early engagement of stakeholders and the nature of the teams' relationships act collectively as solid motivators that prompt integration on the project. As for the engaged operating systems and processes, their contribution towards stakeholder integration cannot be considered insignificant, although lesser than that of the first two factors. However, the latter's role appears to be supportive as opposed to principally causing integration on the project, such as that of the first two.

6.5.3. Significance of the Different Factors within the Families

Within the organization structures grouping (Table 7), all four factors appear to equally contribute to the overall integration level of that group (approximately 25% each). Thus, according to the respondents, the formation of a single integrated team, the formation of integrated project and stakeholder management groups, the early involvement of key participants, and the strengths of the teams' relationships are jointly equivalently significant in affecting integration within the project organization structures.

As for the contractual frameworks (Table 12), the chief and most significant factor influencing integration is the compensation structure adopted on the project (C1: 56.1%). This pertains to tying project profit and loss to stakeholder profit and loss, added to including compensation incentives for cost savings or performance achievements on the project. By tying the individual teams' goals to overall project goals, stakeholders are motivated to collaborate and align their objectives and interests with each other and with the project's. The factors related to implementing a collective risk management approach (C2) and embracing a legal structure that encourages alliance and discourages threatening actions (C3) also have a noteworthy significance in

achieving integration, albeit lesser than C1 (22.3% and 21.6%, respectively). Eventually, project participants appear to be most influenced by the commercial aspects adopted as the ultimate goal of undertaking the project is generating profit for the individual companies.

The factors within the operating systems and processes family reflect varying levels of significance (Table 16). The highest percentage is attributed to collaborative project management processes (P2: 36.1%) which comprise collective generation of a single team focus and objectives, collaborative decision making, and collaborative planning. These functions ensure that all stakeholders feel involved and assume a sense of responsibility toward the final project outcomes, as they actively partake in global - as opposed to local - project management responsibilities. The second highest contributing factor is information sharing (P3: 29.7%) which involves unrestricted cross-sharing of design information on the project and making accounting documents accessible to all project members. Through that, an attitude of transparency and trust is created between stakeholder parties. The third highest factor is the creation of collaborative cultures (P4: 20.7%) through encouraging open communication, a no-blame culture, and team commitment and attitudes. Respondents found that this underlying culture reflecting principles of integration is vital in connecting stakeholders together. Finally, the lowest rated factor relates to utilizing collaborative systems on projects (P1:13.5%). The survey participants seemed to consider using appropriate technology and collaborative information sharing systems not as momentous in their contribution to integration as other factors. Overall, the formers' responses reflect that the day-to-day management processes on the project and the background culture play a more essential role in causing integration than utilizing technologically advanced operating systems.

6.6. Application of the SPV Health Check Tool

6.6.1. Purpose and Contribution of the Tool

The main purpose of the developed tool is, as discussed, calculating the level of integration present between the different SPV stakeholders. It ultimately conducts a "health-check" to evaluate whether the SPV is in fact properly cooperative and integrated and therefore functioning optimally. The developed tool comprises a framework of identified collaboration factors and a final calibrated formula, assigning various levels of significance to the different factors based on the AHP results. However, a main limitation in the AHP is its reliance on the subjective input of the respondents. Therefore, in applying the tool on specific cases, it may be that the calibrated formula is not directly replicable. On the other hand, the main contribution of the tool is the directly replicable structure and framework of factors which may be applied on any PPP project with the studied SPV structure. The calibration of the factors utilizing the AHP would consequently be performed on a case-to-case basis by the involved stakeholders to take into account the respective nature of the applied project and the characteristics of its stakeholders.

6.6.2. Different Applications of the Tool

Considering the lengthy nature of the PPP project, there exists opportunities to apply this tool at various project stages, as follows:

1. <u>During the tendering process:</u> the tool could be used as a means for the public entity to assess and qualify the bidding consortia through generating an notion of the potential integration level of each consortium. Therefore, the output would serve as an additional measure to the pre-qualification criteria adopted by the entity responsible for the tendering process. Further, it would highlight certain collaboration factors to address and incorporate into the various project agreements.

It is significant to note that the application of the tool during the tendering process poses certain limitations related to the time-varying nature of some factors, as opposed to the constant nature of others. The majority of the factors identified in the tool are of constant nature and may be estimated at an early stage, in specific those pertaining to the pre-existing organizational structures of the SPV entity, the set in place contractual frameworks describing commercial and legal terms, and the initial designed operating systems and processes. However, some factors do exist that may prove difficult to estimate at the beginning, such as factors related to actual team interactions and the existing culture during the project (e.g. O4: Strong Team Relationships, P3: Information Sharing, P4: Collaborative Culture). Nevertheless, the customizable nature of the developed framework proves flexible such that these afore factors may be abandoned at the initial stage and the weights instead re-assigned to the remaining constant factors.

2. Across the life-cycle of the project: the tool could also be applied at the various subsequent project stages (design, construction, and operation) to evaluate the integration level of the present stakeholders at different points in time. This practice provides the public sector, on one hand, with a performance indicator of the SPV's functioning for monitoring purposes. On the other hand, it provides the SPV with the opportunity to track and address any perceived flaws in the identified collaboration factors and integration level.

CHAPTER 7
CASE STUDY INVESTIGATION

This chapter presents the case study project investigated in this research. The project is introduced along with a description of all its relevant aspects, with a focus on the SPV entity involved. Next, the results are presented on two fronts, pertaining to: (1) an understanding of the project management mechanisms employed by the SPV on this project, and, (2) the rating of the achievement of the different integration factors and the ultimate stakeholder integration level on this project. The chapter ends with an analysis and discussion of the results along with lessons learned.

7.1. Project Background: Overview, Scope, and Award

7.1.1. Overview

The project selected for the purpose of serving as a case study for this research involves the rehabilitation, expansion, and operation of a well-known international airport in the Middle East region. The specific project name, country, involved stakeholders, in addition to those participating in the case study will be kept anonymous for sensitivity and confidentiality reasons. This will however have no effect on the effectiveness of the case study presentation nor the quality of the established results.

The reasons for choosing this specific case study are twofold. Primarily, it is considered to be the first successful airport public private partnership in the Middle East, as accredited by the one of the world's largest financing institutions. Further, the procurement route and stakeholder structure employed on this project fit the required configuration to be explored in this research. That is, the private entity is structured as a consortium of companies, encompassing both the construction contractor and the

operating contractor, who are involved in project delivery across all its phases under a Build-Operate-Transfer (BOT) contract.

7.1.2. History and Background

Back in 1983, the respective country's government had built and started operating the original airport, henceforth referred to as the "old airport". This was composed of a passengers' terminal building and an airfield system with two parallel runways and taxiways and all other required facilities such as air traffic control, cargo, and catering buildings. The old airport used to be operated by the country's Civil Aviation Authority since the beginning of 1983 and until the effective date of the agreement with the private investor in 2007.

As the air traffic demand increased, it became apparent that the existing airport did not have the capacity to meet the growing demand. To address these limitations, the government sought to undergo a public private partnership in order to reconstruct the airport's terminal and expand its facilities. The primary aim of the project was to increase the capacity of the airport to handle long-term traffic growth. Additional objectives targeted improving airport operations, enhancing the service quality, and serving as a model development for the country's future infrastructure projects. The project comprised the construction of a new terminal to replace the existing terminal, the expansion of the new terminal's related facilities, and the operation of the entire airport under a 25-year contract. Therefore, it was structured as a Build-Operate-Transfer (BOT) procurement route, with the private party assuming the comprehensive project delivery responsibilities from financing to building, operation, and final transfer to the government.

7.1.3. Project Bidding and Award

In order to select the private entity for project award, a comprehensive bidding process was undertaken by the government with the support of international financing consultants. The government initiated the public tender process in 2006, addressing invitations to bid to: international contractors experienced in airport design and construction, international airport operators, financiers, and financial investors. These entities were required to form consortiums in order to bid for the project. Moreover, it was required that each consortium establish that it had the necessary experience in developing, designing, constructing, operating, and financing airports of a similar magnitude. It was mandatory for the consortia to include qualified international contractor(s) and an international airport operator.

After undergoing a prequalification process, six bidding consortia containing over 25 international investors were qualified. The subsequent step consisted of evaluating the financial proposals of the qualified consortia. These proposals were assessed based on the formula of payment relating to the annual concession fees to be offered to the government, as a percentage of gross revenues. Accordingly, the winning bidder would be the one offering the highest financial return to the government. The winning consortium, henceforth referred to as SPV X, won the bid by proposing a concession fee exceeding 50% of the revenues over the life of the contract. In view of that, SPV X and the respective government signed a 25-year rehabilitation, expansion, and operating agreement in 2007.

7.2. Main Stakeholders, Agreements, and Roles

7.2.1. Main Obligations of the Public and Private Entities

In light of the agreement above, the public government and the respective SPV became the two parties of the public-private partnership. Consequently, that resulted in each party assuming certain responsibilities on the project as obligated by that

agreement. This section provides a brief outlining of the obligations pertaining to both SPV X and the government.

Obligations of the Private Entity

The chief obligations of SPV X in performing the PPP project are as follows:

- Operation and maintenance of the airport over a concession period of 25 years.
- Development of the required infrastructure, mainly comprising of the:
  - Immediate improvement of the old terminal.
  - Resurfacing of the existing taxiways.
  - Repair of the existing pavements.
  - Design and construction of a new terminal building.
  - Design and implementation of a new fuel hydrant system.
- Demolition of the old terminal upon the completion and operation of the new terminal.
- Payment of the annual investment fee, as a percentage of the airport gross revenues, to the government.
- Transfer of the airport back to the government at the end of the concession period.

Obligations of the Public Entity

Although the public entity is not directly involved in the provision of services, it does assume some core responsibilities from its part, mainly being to:

- Guarantee the loan from the external financing entities.
- Facilitate the cooperation with the relevant state authorities.
- Assume the responsibilities of the airport aviation security.

7.2.2. SPV Stakeholders and Project Financing

The main stakeholders on the project consist of the public entity, represented by the government, and the private entity, represented by the SPV. Although there are several other involved entities on the project, project delivery essentially occurs at the level of the SPV, with other entities having less direct involvement. This is supported by the previously listed obligations of the public and private entities, confirming that the SPV is the party directly involved in service delivery, while the government assumes background supportive functions. Further, the purpose of this research obligates that the focus be on the SPV itself and its involved members, as the aim is studying the collaboration between these participants in delivering the PPP project. Therefore, the following discussion will shed light on the SPV stakeholders, structure, roles, and chief agreements as related to this private entity.

SPV X was formed as a consortium comprising of: (1) a joint venture of two international contractors (the SPV Contractor), (2) an international airport operator (SPV Operator), and (3) regional and local financial investors (SPV Investors), brought together for their experience in finance, airport operations and construction. Together, these entities formed SPV X as a registered company representing the private sector in the partnership and in charge of undertaking the project across all its phases.

All the entities listed above, as members of SPV X, also act as equity shareholders in the project company that invest financially in the project. The project financing was acquired through two main sources: the first is equity from the SPV X shareholders and the second is long-term debt from external financing institutions referred to as the project "Lenders". In this specific project, the respective investment percentage varies from one shareholder to another, with the SPV Contractor holding a 19.5% share, the SPV Operator holding a 9.5% share, and the financial investors holding a total of 70% (divided 40%, 20%, and 10% across the three investors).

Because the equity investments in the project are not sufficient to cover the entire project costs, the remaining amount is acquired through loans from the Lenders.

7.2.3. Main Project Agreements

The main agreements between the involved stakeholders on the project include:

- The Rehabilitation, Expansion, and Operation Agreement (REO): This is the agreement between SPV X and the government or public entity. Through this agreement, the general responsibilities of both parties are set in relation to the overall project delivery, with a focus on both the financial and technical aspects of the project.
- The Shareholders Agreement: This is the agreement between the shareholders of SPV X as comprising of the entities previously listed. The agreement describes the overall management operations of the SPV, including the decision making mechanisms, and the revenue sharing schemes, among others.
- The Engineer, Procure, and Construct Agreement (EPC): This is the agreement between SPV X and the SPV Contractor for the provision of engineering, procurement, and construction services.
- The Technical Services Agreement: This is the between SPV X and the SPV Operator for the provision of operating and maintenance services.
- Common Terms Agreement: This is the agreement between SPV X and the Lenders or financing institutions that would provide loans to the SPV for project financing.

Table 22 presents a general representation of the contractual structure and agreements on the project.

Table 22: SPV Project Agreements

Contract/Agreement	SPV X	Government	SPV Contractor	SPV Operator	Lenders
REO Agreement	x	x			
EPC Agreement	x		x		
Technical Services Agreement	x			x	
Common Terms Agreement	x				x

7.3. Case Study Results

7.3.1. Objective 1: Understanding the SPV Management Mechanisms

A) General Overview

The first research objective focuses on two fronts: (1) investigating the core characteristics of the SPV as stemming from the fundamentals of the PPP delivery route, and (2) exploring the SPV management mechanisms on the project in order to understand how PPP projects, as different from traditional projects, are governed. Chapter 5 [*Identifying SPV Integration Characteristics*] addressed the first front by presenting and linking the different features of the SPV that reflect the collaboration potential of its stakeholders. This following section shall target the second front, specifically studying the entity in charge of project management in terms of its components, structure, and functions. The project management entity formed on the project is introduced and described and its management methodologies delineated. The afore approaches are examined and analyzed to study whether the intrinsic advantages of the PPP procurement route are being reaped on this specific project. This analysis is supported by reasoning based on the contractual structure and the level of the different stakeholders' equity contributions within the SPV organization. The results of this section pave the way for addressing the second research objective through calculating the degree of achievement of the different integration criteria and, ultimately, the overall level of integration on the project.

B) Components and Structure

On the airport project, the project management body comprises a team of administrative, legal, and technical personnel elected by the board of SPV shareholders. Therefore, this group is considered an independent project management group. Further, there is no direct representation of the different project teams within this management entity as it is not formed of representatives of the different players. Figure 11 below depicts a general demonstration of the management group's organization structure on the project. For ease of reference, this entity will hereafter be referred to as "SPV M".

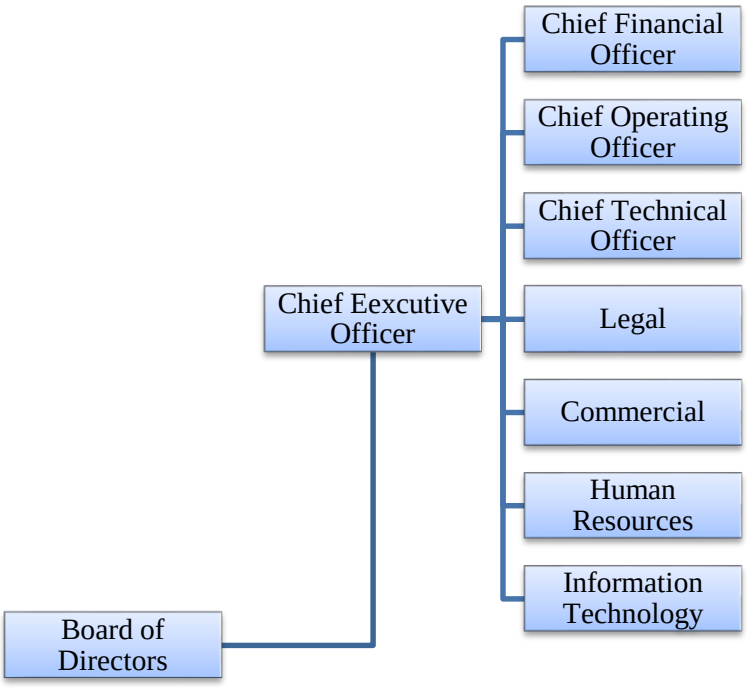

Figure 11: Organization of the Project Management Entity (SPV M)

C) Project Management Functions

The above organizational structure verifies that this entity is significantly staffed and resourced and forms an integral team on the PPP project. This fact is a requirement to allow it to handle the management functions at the overall project level.

SPV M carries the roles of a typical project management entity on a traditional project, being responsible for planning and organizing all project operations, managing the entire project risks, coordinating with the different teams providing services on the project, and communicating with the external project teams including the government, involved authorities, and project Lenders. To describe it more concisely, SPV M's general role is managing the different contracts of SPV X on the project. It is responsible for the day-to-day management of all the tasks on the project in addition to the involved project stakeholders, including the service providers. The board of directors, representing the SPV X shareholders electing SPV M, is only involved in upper level management and operating decisions and does not take part in the day-to-day management efforts of SPV M.

D) Local and Global Project Management

An important point brought forth centers around the presence and roles of the main service providers, being the SPV Contractor and SPV Operator, in project management. The afore entities are involved in SPV X in their capacity as shareholders, on one hand, and involved in the project in their capacity as service providers, on the other. As a result of this involvement, one would expect these teams to be direct participants in the management of the overall project. This is anticipated to be brought forth by the inherent advantage present in PPP projects, which conceptually allows the alignment of interests of the service providers with the project interests due to the formers' presence as equity shareholders.

However, going back to SPV M's structure and functions, the fact arises that the former management entity does not integrate the different parties on the project in overall project management, specifically those entities in charge of service provision. Remarkably, on this project, these entities only take part in managing their own works and mitigating their own risks, with no regard to overall project operations, undergoing what is described as "local management". The fact that they are SPV X shareholders

should allow them to take part in “global management” at the entire project scope. Nevertheless, on this specific project, this contribution is mostly conceptual. The main reason behind this is the SPV Contractor’s and Operator’s relatively low percentage of shares in the SPV, as will be discussed later in more detail. Yet, the general concept is that these service providers are only involved in the overall management decisions taken by the board of directors of SPV M in their capacity as shareholders with limited power and influence corresponding to their limited shares within SPV X.

This lack of integration between local and global project management results in a duplication of project management efforts, which is a waste of time and cost. More importantly, it results in creating a sense of individuality between the different players, which re-establishes the traditional project structure, whereby each entity is responsible for managing its own risks and there is a misalignment of interests, which is disadvantageous to the project. The core issue behind this problem, which is the low equity contribution of the service providers in the SPV, is discussed in more detail in Section 7.4.2 *[Project Shortfalls and Lessons Learned]*.

7.3.2. Objective 2: Rating the Integration Factors and Calculating the SPV Integration Level

A) General Overview

The second objective involves investigating the SPV’s organizational structures, contractual frameworks, and operating systems and processes in order to evaluate the level of integration achieved on the project. This section provides an assessment of the specific related criteria in terms of their degree of achievement. The rating is a self-assessment by the writer, supported by substantiations based on the gathered project facts. A 5-point Likert scale is used to rate the different factors, as defined in figure 12 below. The lower range of the scale (1) means that the factor was

not achieved, the middle range (3) represents a partially achieved factor, and the upper range (5) signifies a fully achieved factor. (2) and (4) are used as intermediate values.

Figure 12: 5-Point Likert Scale

B) Organizational Structures

Table 23 presents the rating of the different factors under the organization structures grouping along with the relevant justification.

Table 23: Rating of Factors under the Organization Structures Grouping

ID	Factor	Rating (1-5)	Justification
O1a	Team is co-located	3	Co-located geographically on the project but every SPV stakeholder has its own separate offices building.
O1b	Qualified organization and leadership	5	The organization and leadership is dedicated to the most qualified and competent personnel in their respective fields.
O1c	Equitable team relationships and opportunities for project input	3	Opportunities for the SPV members' input are available on key project decisions. However, team members contribution is restricted to their functional project role and contribution of shares in the SPV.
O2	Early involvement of key participants	4	All key SPV participants are involved from day 1. However, this could benefit from the involvement of authorities and external related stakeholders.
O3a	Multidisciplinary project	3	SPV M is the project management entity representing the different SPV members. However, it is independent and

	management group		does not integrate specific representatives from each team.
O3b	Multidisciplinary relationship management group	4	SPV M acts as the group responsible for managing the different stakeholder interactions and relationships.
O4a	Previous experience in partnering approaches	5	All members of the SPV were experienced in PPP project delivery.
O4b	Previous history of teams	1	The SPV members has no previous working history.
O4c	Compatibility of stakeholder teams	4	The SPV members were all from separate countries but did not experience severe issues due to cultural differences.
O4d	Harmonious inter-personal relationships	5	The working relationships of day-to-day personnel was harmonious and undisturbed by upper level tensions.
O4e	Participation of top management	4	The top management of the different teams provided the required resources and support for project operations.

C) Contractual Frameworks

Table 24 presents the rating of the different factors under the contractual frameworks grouping along with the relevant justification.

Table 24: Rating of Factors under the Contractual Frameworks Grouping

No	Factor	Rating (1-5)	Justification
C1a	Pain sharing and gain sharing	4	The Shareholders Agreement contains provisions for pain sharing and gain sharing. However, the low equity contribution of the service providers acts against this purpose to some extent.
C1b	Compensation incentives	3	No specific compensation incentives exist that motivate the SPV Contractor to achieve certain goals. However, the SPV Operator has incentives in relation to service provision and management.
C2	Collective risk management	3	SPV M manages all project risks collectively. However, every individual party manages its own risks without contributing to overall project risk management.

C3a	Presence of a multiparty agreement	5	An SPV Shareholders Agreement was signed between all the involved SPV members.
C3b	Withdrawal is discouraged	3	The Shareholders Agreement prevents withdrawal of any SPV member. However, a loophole exists that allows it in case of a uniform consent by all SPV members.
C3c	Waiver of claims	5	The Shareholders Agreement disallows claiming between the SPV members (except for cases of professional negligence and illegal acts).
C3d	Internal dispute resolution	5	The Shareholders Agreement encourages dispute resolution within the project environment as alternative to external courts.

D) Operating Systems and Processes

Table 25 presents the rating of the different factors under the operating systems and processes grouping along with the relevant justification.

Table 25: Rating of Factors under the Operating Systems and Processes Grouping

No	Factor	Rating (1-5)	Justification
P1a	Appropriate technology	3	There was no focus on utilizing specific technology that facilitates collaboration between participants. Yet, the technology used did not particularly hinder communication.
P1b	Integrated design sharing platform	2	No particular integrative design sharing platform was used.
P2a	Collective generation of a single team focus and objectives	3	Members pursue individual objectives but mostly in line with the overall project objectives.
P2b	Collaborative decision making	3	Collaborative decision making exists only for upper level decisions while every SPV member takes its own decisions as related to its works.
P2c	Collaborative planning	2	In general, SPV team members plan their own works and collaborative project planning only exists at higher levels.
P3a	Unrestricted cross-sharing of design information	5	Parties openly share design information across the SPV.

P3b	Accounting documents open to all members	3	Accounting information are shared and accessible to all SPV members but there are several attempts to hide specific information from certain members.
P4a	Open communication	3	Communication mostly follows the traditional procedural formalities and protocols.
P4b	No-blame culture	3	This is partially achieved as the general ambience follows the claim-free environment set by the contract. However, the atmosphere of team segregation reflects some aspects of blame appointment to separate teams by others.
P4c	Team commitment and attitudes	2	Team commitment is limited as an attitude of segmentation and team individuality exists between the different SPV stakeholders.

E) Calculating the Degree of Integration

Reference to Appendix C (Tables A1-A5; B1-B4; C1-C5) containing the detailed calculations worksheet, the below grades for the factors are identified along with the integration levels of the different factors and overall project integration level (Tables 26, 27, and 28).

Organizational Structures

Table 26: Grades for Factors O1 to O4

Factor	Description	Grade
O1	Single Integrated Team	3.67
O2	Early Involvement of Key Participants	4
O3	Integrated Project and Stakeholder Management	3.5
O4	Strong Team Relationships	3.33

$$Integration\ Level\ (O)\ = 0.247 \times O1 + 0.251 \times O2 + 0.250 \times O3 + 0.252 \times O4$$

$$Integration\ Level\ (O)\ = 3.62$$

Contractual Frameworks

Table 27: Grades for Factors C1 to C3

Factor	Description	Grade
C1	Compensation Structure	3.5
C2	Collective Risk Management	3
C3	Legal Structure	4.33

$$Integration\ Level\ (C)\ = 0.561 \times C1 + 0.223 \times C2 + 0.216 \times C3$$

$$Integration\ Level\ (C)\ = 3.57$$

Operating Systems and Processes

Table 28: Grades for Factors P1 to P4

Factor	Description	Grade
P1	Collaborative Systems	2.5
P2	Collaborative Project Management	2.67
P3	Information Sharing	4
P4	Collaborative Culture	2.67

$$Integration\ Level\ (P)\ = 0.135 \times P1 + 0.361 \times P2 + 0.297 \times P3 + 0.207 \times P4$$

$$Integration\ Level\ (P)\ = 3.04$$

Project Integration Level

$$Overall\ Project\ Integration\ Level\ = 0.373 \times O + 0.432 \times C + 0.195 \times P$$

$$Overall\ Project\ Integration\ Level\ = 3.49$$

7.4. Discussion and Analysis

7.4.1. Project Integration Level

In order to analyze that achieved results, we first have to define a scale of integration that facilitates relative comparison with the different project settings. The identified scale follows the same range as the previously used 5-point Likert scale in rating the degree of achievement of integration on the project. The lower end (1),

representing the non-achievement of integration on the project, is identified as related to "low integration project" settings. By that, we are mostly referring to projects presenting stakeholder structures where each team has its own separate camp, manages its own risks, and follows its own aims and objectives as separate from the project's interests. This is considered the furthest away from our desired integrated setting. It is significant to note that this classification is based on the fact that characteristics of these procurement routes, in terms of organization structures, contractual frameworks, and operating systems and processes, are divergent from integrated project delivery features. Therefore, it is the intrinsic nature of the procurement route that is considered in this cataloging, rather than the actual interactions of the different teams on these specific projects. The upper end of the spectrum (5), where integration is maximal, represents the "high integration projects" setting. These project settings are understood to reflect an atmosphere of ultimate collaboration, open communication and transparency, sharing of resources, and alignment of interests. The above identified scale along with the described labels are identified in figure 13 below.

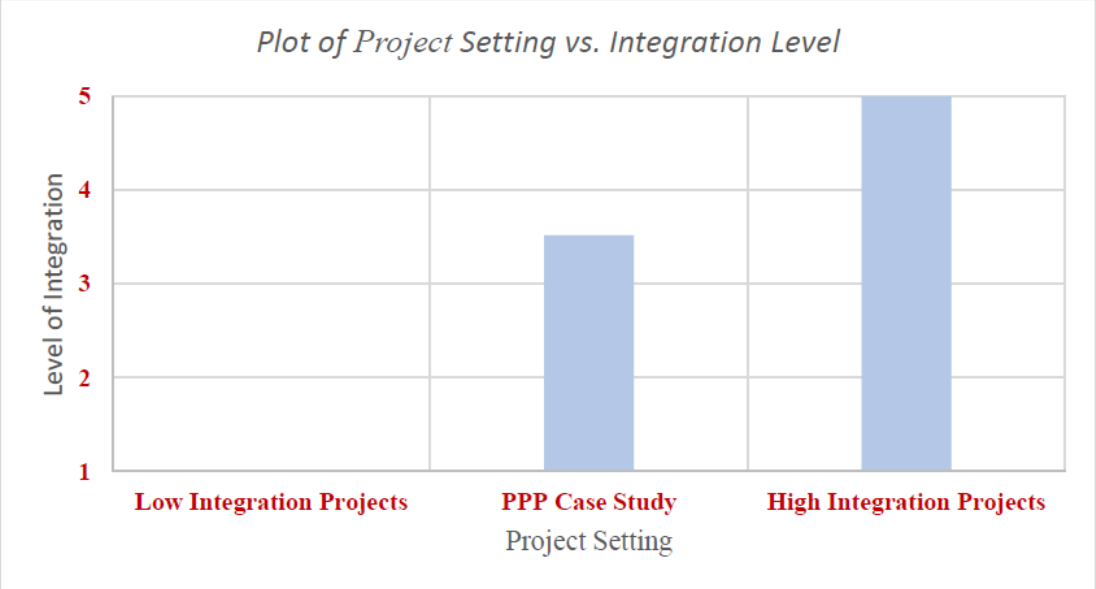

Figure 13: Plot of Project Setting versus Integration Level

Plotting our achieved integration level of 3.49 on the scale shows that the PPP project considered in the case study achieves a little more than partial integration, falling almost midway between low integration settings and high integration settings. Therefore, this project presents an improvement from the low integration project setting, accomplishing a considerable level of integration. However, when compared to high integration settings, the studied project suggests that it has yet to reach this ultimate integration level as it is not achieving its full collaboration potential. The reasons behind that, as related to the rating of the separate factor groups, are described below.

The organization structures grouping presents an integration level of 3.62, indicating a slightly higher than partially achieved integration structurally. Having a single integrated team (O1) receives a rating of 3.67, leaning also towards partial achievement. This is mostly due to the fact that the teams are not co-located within the same office environment (O1a = 3) and each team's opportunity for project input is dictated by its percentage of shares in the project company (O1c = 3). The early involvement of key participants (O2) achieves a high rating of 4, as the main key stakeholders are involved early on. However, this could also benefit from the participation of relevant authorities and related airlines as their input is required during the design and construction phases. Factor (O3) representing integrated project and stakeholder management obtains a relatively low rating of 3.5 as the project management functions are more concentrated locally than globally. Yet, partial achievement of this factor is due to the presence of integrated project management functions pertaining to higher level project decisions. Finally, factor O4 depicting strong team relationships also reflects a partial achievement level of 3.33. Nevertheless, the big part of individual factors contributing to O4 are highly rated, with the exception of (O4b: previous history of teams) receiving a low rating and thus shifting the overall degree downwards.

The integration level related to the project's contractual frameworks is 3.57, also presenting a partially achieved rating. While the compensation structure (C1) generally addresses pain sharing and gain sharing formulae (C1a = 4), it does not fully focus on having compensation incentives (C1b = 3), providing the latter only for the operator and not for the contractor and resulting in a partial achievement of 3.5 for C1. Collective risk management (C2 = 3) is partially achieved as the project management entity (SPV M) manages risks collectively; yet, each party focuses on managing its own risks and does not contribute to overall risk management. Considering the legal structure on the project (C3 = 4.33), the results indicate a significantly high degree of achievement of this factor. Most of its different contributors are implemented on the project, ranging from the multiparty agreement (C3a = 5) to the waiver of claims and focus on internal dispute resolution (C3c = 5; C3d = 5). The discouragement of withdrawal is only partially achieved (C3b = 3), as although it is present in the SPV Agreement, loopholes exist to go by it. The contribution of the overall factor C3 in the ultimate equation is less than that of C1 and C2, as per the AHP survey ratings, and thus the results are mostly influenced by the former.

Finally, the operating systems and processes on the project achieve a partial integration level of 3.04. Collaborative systems (P1) reflect a low grade of 2.5 showing that there is no focus on using technology that facilitates collaboration (P1a = 3) nor a platform for design integration and sharing (P1b = 2). Collaborative project management processes is also low rated (P2 = 2.67) since the decision making and planning do not happen collaboratively for day-to-day project functions and is only present for upper level project management. Information sharing (P3) receives a high rating of 4 as design information is shared unrestrictedly (P3a = 5) while accounting and financial information witness attempts of concealment from separate teams (P3b = 3). For example, the CEO of SPV M would attempt to hide budget related data from the SPV Contractor considering the latter to have a conflict of interest when it comes to

variations and scope increases. Finally, the forth factor (P4: collaborative cultures) reflects less than partial achievement (2.67) due to the absence of team commitment and attitudes (P4c = 2) and the low levels of open communication (P4a = 3) and a no-blame atmosphere (P4b = 3).

All the three main groupings present levels nearing partial integration (O = 3.62; C = 3.57; P = 3.04) and hence the overall project integration level also leans towards partial integration (3.49). The most influencing group is the contractual frameworks, having a contribution of 43.2% towards the final integration level, followed by the organization structures grouping with a degree of 37.3%. Consequently, these categories have the major share in manipulating the project integration level. Reference to table 29 indicating the individual contribution of the different factors to the overall integration level, it is apparent that the commercial or compensation structure (C1) is the single top controlling factor to the overall result with a 24% impact. Thus, the 3.5 rating of this factor has indeed contributed to swaying the results towards partial integration.

ID	Factor	Overall Contribution to Integration (%)
C1	Compensation Structure	24.24
C2	Collective Risk Management	9.63
O4	Strong Team Relationships	9.4
O2	Early Involvement of Key Participants	9.36
C3	Legal Structure	9.33
O3	Integrated Project and Stakeholder Management	9.33
O1	Single Integrated Team	9.21
P2	Collaborative Project Management	7.04
P3	Information Sharing	5.79
P4	Collaborative Culture	4.04
P1	Collaborative Systems	2.63

Table 29: Overall Integration Coefficients of the Different Factors

7.4.2. Sensitivity Analysis

The analysis performed in the above case study assumes that both the coefficients and the rated factors of the equation are of deterministic nature as they are symbolized by exact numerical figures, as opposed to ranges. However, for better representation, it is necessary to consider an error range for the input variables and study its effect on the output integration level to quantify the degree of variance. Therefore, to address that loophole, a sensitivity analysis is conducted assuming a variance range of 5% for the (a) integration equation coefficients and (b) input factor scores. To elaborate, the coefficients and factors are varied by 5% upwards and downwards and the upper and lower bounds of resulting integration level are henceforth calculated. The detailed calculations are enclosed under [*Section E – Sensitivity Analysis*] of Appendix C. The results, as reflected in Table 30 below, indicate that our obtained integration level ranges from 3.15 to 3.84. This represents a variance percentage of 9.74% as the lower limit and 10.03% as the upper limit, both approximately within a 10% range. Considering our defined scale of integration (ranging from 1 to 5), these values still hold nearly the same relative position on the scale and hence are not considered to significantly vary. The deterministic analysis conducted in the case study is therefore representative with a relatively low degree of error.

Table 30: Variance Range from Sensitivity Analysis

	-5% Error Range	Deterministic Value (Case Study)	+5% Error Range
Degree of Integration	3.15	3.49	3.84
Percentage Variance (%)	9.74		10.03

The following section outlines a number of major shortfalls that have contributed to the above results and should be targeted in order to enhance integration and allow the PPP to accomplish its IPD potential, as identified by both the interviewed project stakeholders and the researcher herself. Additionally, methodologies to address the former shortfalls in addition to lessons learned on the project are presented.

7.4.3. Project Shortfalls and Lessons Learned

A – Related to SPV Stakeholder Integration Factors

1) Adopting integrative commercial frameworks

Results of the AHP survey have emphasized the significant influence of the compensation structure on stakeholder integration. Ultimately, all stakeholders are primarily impacted by the remuneration received at the end of the day. The studied project reflects a partial achievement of this factor (C1), mostly due to the fact the compensation incentives were not made available for the SPV Contractor. Therefore, providing incentives that tie the Contractor's achievement of certain goals to additional reward would aid in addressing the aforesaid shortfall. Examples of these incentives is awarding the Contractor a portion of the costs saved when he undergoes value engineering efforts resulting in a reduced cost to the project. Through that, the former would not worry about losing profit from reduced work as he is getting compensated in return.

2) Integrating stakeholders in global project management

The issues arising from having an independent project management entity as opposed to one integrating representatives of all the involved stakeholders have been discussed in detail in Section 7.3.1. The significance of involving all project teams in overall project management, encouraging collaborative planning and decision making, and aligning risk management and sharing efforts can be observed in the influence of a number of identified factors on the level of project integration. Referring to table 29

above, factors C2 (Collective Risk Management), O3 (Integrated Project and Stakeholder Management), and P2 (Collaborative Project Management) are directly influenced by the subject issue and contribute a significant 26% to the overall stakeholder integration (9.63%, 9.33%, and 7.04%, respectively). Therefore, having an integrated project management entity that encourages cooperation of all involved stakeholders in managing the complete project scope and risks is paramount to the realization of partnership on this level. This is a core contributor to aligning interest and achieving the optimal returns of the PPP procurement route.

B – Related to Other SPV Functions

1) Ensuring a weighty equity contribution by the service providers

As previously discussed, the SPV Contractor and the SPV Operator on the project play two roles as SPV equity shareholders, on one hand, and as service providers, on the other. While, conceptually, this dual involvement is thought to serve the purpose of aligning goals and triggering stakeholder integration, the studied project setting signifies a misalignment of stakeholder interests and disintegrated management efforts, as detailed beforehand in Section 7.3.1. The main reason contributing to the afore issue is the low percentage of shares taken by both the SPV Contractor and the SPV Operator in SPV X. While the former holds a 19.5% share on the project, the latter holds a 9.5% share, both considered insufficient to enable reaping the real benefits of PPP projects, as will be described hereafter.

In concept, the presence of these service providers as equity shareholders in the project serves the purpose of unifying the SPV team by aligning the stakeholders' interests with the project interests. That is, the project's losses and profits is equivalent to the SPV stakeholders' losses and profits, and vice versa. However, in this case, the low equity contribution of the players results in their being shareholders "by name", for the sole purpose of buying their way into the project. To elaborate, the SPV Contractor

and SPV Operator only take on a representative share that would enable them to take part in SPV X and reserve their place as service providers on the project. This automatically leads to the segmentation of the different participants and the traditional "every man for himself" attitude, as the concept of sharing risks and rewards on the project evaporates. The chief damaging contributor leading to the afore scenario is that considering that the SPV Contractor's profit margin on the works is 30% and his shares percentage is 19.5%, a variation order on the project that would lead to a loss to SPV X but additional work to the contractor would still allow him to profit from a net 10.5%. Therefore, while the SPV X, which includes the SPV Contractor, would suffer a loss from additional unanticipated works, the latter would actually benefit from it as his profit margin far exceeds his equity participation. The same case applies to the SPV Operator. The potential benefits from involving these entities as both shareholders and service providers are lost and replaced by a conflict of interest due to these dual functions.

Consequently, a significant equity contribution in the SPV is a prerequisite to secure the intrinsic advantages offered by the PPP procurement route. This contribution has to be at least in excess of the service providers' profit margin. Through increasing the stakeholder percentage shares, the stakeholders' risks on the project are increased and an alignment of interests is facilitated. The absence of this requirement on the studied project has indeed affected it negatively on several fronts, as admitted by the interviewed stakeholders.

2) Organizinging the process of SPV stakeholder withdrawal

As previously described, the SPV Shareholders' Agreement contains provisions that discourage the withdrawal of any SPV shareholder from the project. This comes with the purpose of ensuring that the equity contributors are involved as long as possible in the project, preventing the "touch-and-go" mentality focused on short-term profit gain. Further, this safeguards reaping the advantages of the long term

nature of PPP contracts, mainly the optimization of life-cycle costs and improvement of service quality. While, optimally, one might wish to tie the DB Contractor in specific to the SPV from project start to end, it is both logical and expected that this contractor, in reality, will seek to leave the project and sell his shares when he has performed his scope following the construction stage. Therefore, it becomes essential to plan and organize an exit strategy so as to prevent the party leaving from profiting blindly while eventually harming the project interests. On this PPP project, the withdrawal provision is accompanied by a loophole that allows for the departure of an equity shareholder provided that the others agree to it. This provision is not accompanied by any means or plan to safeguard project interests in the event of such occurrence. In fact, around the time of undergoing the study in June 2018, the SPV Contractor had sold his shares and withdrawn from the project as an investor while still performing some works as a contractor. That way, the former was able to achieve his profits and benefits while compromising on the overall success of the project, which is against the purpose of the long term agreement. Consequently, it is significant to include provisions in the Shareholders' Agreement that address and manage this risk of stakeholder withdrawal and maintain proper project functioning upon its occurrence.

3) Involving people familiar with the culture in key positions

The interviewed participants highlighted the necessity of involving people familiar with the culture of the end users in the key positions on the project. PPP projects, due to their vast scale and scope, most often involve multinational companies to take charge of project design, construction, and operation. However, an aspect to be considered – specifically in project design – is the cultural requirements of the end users. For example, on this project, the foreign design entity overlooked a critical aspect related to the provision of praying rooms to account for the specific religious environment. That issue eventually led to re-work and re-design to encompass the afore requisite. Additionally, having people familiar with the environment on board was also

claimed by the interviewees to facilitate communication with the public entity, local authorities, and subcontractors, among others.

4) Securing the support of the public entity

The final shortfall, as documented by the SPV stakeholders, is not related to the internal SPV relationships but rather to the relationship with the public entity. Although the focus of this research is on project delivery at the SPV level, we cannot ignore the significance of the public-private association. The SPV stakeholders considered it substantial that the public entity acts as a real partner through sharing both the profits and the losses on the project, instead of only the former which is the case on this project. Additionally, they identified the requirement to provide a fair financial model for levying the concession fees by not collecting these fees too early on in the project while the stakeholders have not yet started generating profit and are struggling in repaying their loans to the Lenders. Therefore, support from the public partner is required, specifically on the commercial level, for successful project implementation.

7.4.4. Concluding Notes

Analyzing the overall results obtained from this case investigation verifies that this PPP project has succeeded in achieving a certain level of integration, albeit partial, but either way presenting a development from the low integration project setting. The project has in many ways succeeded in satisfying specific collaboration criteria, especially pertaining to the legal aspects of the SPV agreement. A deeper analysis of the results would show that the level of integration on this project is due to the intrinsic characteristics stemming from the PPP delivery route, rather than active stakeholder participation to cause integration. This conclusion supports the results of previous PPP studies that have stated that SPV relationships, although presenting an improvement from the historic adversarial behavior on traditional projects, come forth as a passive reaction to the structural change instilled by the PPP procurement route (Smyth and

Edkins, 2007). Hence, as previously detailed, the project has much room for addressing certain cooperation factors that would enable it to significantly improve its achieved levels of stakeholder integration and ultimate project success. That is, the need arises for active participation in designing the PPP project's organization structures, contractual frameworks, and operating systems and processes with the goal of realizing optimal stakeholder integration.

Classifying the project as a success or failure is not reasonable as project success does not have one definition and varies depending on the perspective. For instance, the following list of project outcomes display the substantial benefits of the subject PPP:

- The project encompassed a $700 million investment, fully financed by the private sector.
- The project generated sizable profit to the public sector, reaching approximately $200 million annually.
- The airport capacity was increased from 4 million to 12 million passengers. Greater capacity resulted in stimulating trade and driving economic growth.
- A considerable number of 23,000 jobs were generated through the airport reconstruction and operation.
- The level of service at the airport witnessed a vast improvement, placing the airport among the 20 best airports in the world as per passenger votes and among the 50 top airports for service levels in ACI's Airport Service Quality (ASQ) Survey.
- The project was key to supporting the tourism industry, the latter forming 10 percent of the country's Gross Domestic Product (GDP).

Considering the above, the airport could be considered a success from that perspective, through the benefits generated to the public sector, the end users, and the economy. Additionally, from a purely financial perspective, the project would also be considered

as a success as it does guarantee a positive return on investment. Yet, a key project stakeholder stated that the afore financial success was mostly due to the greater than expected project traffic, as the project would not have witnessed such success had the planned economic forecasting been accurate. Nevertheless, as the focus of this research is evaluating the stakeholder integration level, the PPP is not considered fully successful as it is not achieving its full integration potential.

CHAPTER 8
CONCLUSIONS AND RECOMMENDATIONS

8.1. Research Summary

Public-Private Partnerships have been on the rise worldwide, and over a 25-year lifespan (1991-2015), investments in PPPs have totaled $1.5 trillion on more than 5,000 infrastructures projects in 121 low and middle-income countries (World Bank, 2016). The World Bank Group estimated that as of 2016, over 2.4 billion people were short on quality sanitation, over 663 million people required safe drinking water, over one billion people lacked access to electricity, and at least one-third of the world's rural population was not served by an all-weather road (World Bank, 2017). Consequently, the need and expectations remain for the continuing rise of PPPs as the optimal solution for public entities with budgetary constraints to address the afore listed problems. PPPs enter the construction sector as a new contract, procurement, and relationship type (World Bank, 2009). It is therefore essential to thoroughly investigate the implications of such a novel delivery route on the existing construction environment, specifically pertaining to the involved project stakeholders. A significant stakeholder entity to study is the private project company, or the Special Purpose Vehicle (SPV), formed to undertake the partnership contract and deliver the project across all its phases. The features of the SPV, acting as a consortium combining the parties involved in PPP project delivery, bear substantial similarities to the Integrated Project Delivery (IPD) system. As existing literature seems to fall short in delineating the core features of the described entity, specifically in terms of its management mechanisms, collaboration characteristics, and integration potential, there is a requirement to fill such gaps. This research aims to contribute to the PPP body of knowledge through a particular focus on the SPV and its methodologies in delivering services as a unified body. Stakeholder integration is

identified as a prerequisite and a contributor to SPV management efficiency and PPP success. The research proposes an SPV Health-Check tool – consisting of identified integration metrics – to provide a measure of SPV stakeholder integration. Accordingly, this thesis introduces the lean vein into PPP research and is the first of its kind that strives to study the SPV delivery route from an integrated project delivery perspective. Its contribution is twofold in adding to the PPP literature by investigating the SPV stakeholder management mechanisms in reality, on one hand, and in evaluating the SPV's integration level as an enabler of successful relationship management, on the other.

The research follows a thoroughly designed methodology in carrying out the study and presenting the results. The first step consists of knowledge acquisition and background research on three fronts: a) features of the PPP procurement route and SPV project delivery, b) integrated project delivery and its foundations, and c) studies and measures of stakeholder integration on construction projects. Accordingly, research gaps are identified and research objectives and contributions are set. Next, the study addresses its first objective through establishing and describing key SPV integration characteristics, derived from features of PPPs, which promote stakeholder collaboration and link the SPV to integrated project delivery. This is achieved through reliance on the background literature and investigative studies on one hand, and through interviews with professionals with direct experience in the PPP industry on the other. In order to address the second objective, namely to evaluate and quantify SPV stakeholder integration, collaboration metrics that measure such integration are proposed in relation to the procurement route's organization structures, contractual frameworks, and operating systems and processes employed by the SPV. These factors, as inspired by the IPD system, are subsequently rated through a survey addressed to industry professionals using the Analytical Hierarchy Process (AHP). The final result is a comprehensive tool, formed of measuring factors with different degrees of significance, which calculates the

overall achieved integration level within the SPV. An international PPP airport in the Middle East is investigated through interviews with the key SPV stakeholders in order to explore the SPV management mechanisms and examine its collaboration success in terms of its achieved degree of integration. The study results provide noteworthy learned lessons and recommendations.

8.2. Research Implications and Recommendations

This study imposes several practical implications and recommendations, to be considered by practitioners in the PPP industry, which aim to enhance PPP project delivery and service provision and facilitate the success of these projects. The following list comprises recommended practices to be adopted by PPP participants to enhance collaboration success:

- SPV members should recognize the essentiality of stakeholder integration within the SPV from the point of inception, and structure its project delivery mechanisms with the purpose of achieving such goal. The SPV should address collaboration at the level of the organization structures, contractual frameworks, and operating systems and processes.

- The public entity may adopt the developed SPV Health Check tool during the tendering process as a means to assess and qualify the integration potential of the bidding consortia. SPVs may use the tool to calculate the actual integration level on the project and pinpoint areas of weakness that may be appropriately addressed. As detailed in *Section 6.6 [Application of the SPV Health Check Tool]*, the developed framework – composed of the collaboration factors – would be directly replicable for application on any PPP project adopting an SPV. Additionally, the flexible nature of this framework allows for neglecting the time-related factors at the initial tendering stages when they are difficult to estimate. However, the application of the tool must involve a case-to-case AHP rating process by the involved parties to increase the

accuracy of the outcome results by addressing the subjective nature of the AHP and considering the specificity of the particular case.

- The SPV is to structure the commercial frameworks – as the highest rated integration contributor in this research – to encourage the sharing of profits and losses between participants and encompass compensation incentives to the service providers.

- The SPV is to employ an integrated project management group that comprises representatives from the different SPV members to involve all SPV participants in global project risk management and align their interests with the project's.

- The SPV is to ensure that the equity contribution of the service providers – mainly the SPV Contractor and SPV Operator – pointedly exceeds their profit margins in order to avoid the "touch-and-go" mentality and preserve the alignment of risks, profits, and losses.

- The SPV is to guarantee that the terms employed in the shareholder's agreement contain a well-designed exit management strategy to safeguard the project's interests in case of stakeholder withdrawal.

- The public entity should be aware of its noteworthy supportive role to the SPV by structuring a flexible financial arrangement between the two to avoid levying taxes and concessions early on in the project and hindering SPV performance.

8.3. Limitations and Future Research

8.3.1. Identifying Additional Collaboration Metrics

This research has identified specific metrics falling under the three groupings of organization structures, contractual frameworks, and operating systems and processes – as inspired by the principles and foundations of IPD. However, it should be noted that this limitation of factors is a weakness as there is an opportunity for projecting

additional collaboration principles and developing further measures to provide more a comprehensive evaluation of stakeholder integration.

8.3.2. Number and Nature of Respondents

The rating of the identified collaboration factors was undergone by a limited number of 20 respondents, albeit mostly professionals in the construction industry. These results could further benefit from undergoing additional evaluations to increase the available data and provide more accurate representations. Further, the nature of respondents should be emphasized to target PPP participants in specific, as they are the most familiar with such project characteristics. Taking it a step further, the rating of the relative significance of the factors could be done on a case to case basis, targeted mainly at the specific involved project stakeholders being investigated. Through that, the developed tool would be customized to each particular project. Additionally, the limitations stemming from the largely subjective nature of the AHP would be properly addressed through customization.

8.3.3. Analyzing the Variance in Reponses Based on the Respondents' Backgrounds

The AHP survey has been undertaken by a number of respondents coming from different organizational backgrounds. These backgrounds span across organizations of developers, financing entities, design consultants, project management consultants, construction contractors, and governmental entities. Therefore, we would expect these dissimilar bodies to differ in views regarding the significance of the different integration factors, considering that this rating is largely subjective in nature. This creates an opportunity for future research to further analyze these variances based on the participants' backgrounds in order to better understand the results.

8.3.4. Application of the Analytical Hierarchy Process

The AHP in this research has been employed as an accurate method of setting priorities among the different criteria according to their relative significance in contributing to stakeholder integration. However, the AHP was only applied to the first three levels of the factors hierarchy. The factors of the forth level were assumed to carry equal importance to avoid cumbersome and lengthy comparisons. The afore assumption carries inherent limitations and thus there is room for undertaking supplementary assessments by applying the AHP to all levels.

8.3.5. Advancing the Statistical Analysis

The case study section of this research involved a basic form of sensitivity analysis undertaken to generate a notion of the range of error in the output integration level. Nevertheless, this analysis could be considerably advanced in future research through considering the probability distribution of the results and varying the inputs in terms of the calculated standard deviation to determine a more accurate representation of the error involved.

8.3.6. Investigating Additional Case Studies

There is an opportunity for testing the developed tool on other case studies for validation purposes through linking the tool integration results to the actual SPV performance and management success. Accordingly, the identified scale of integration may be modified to incorporate these case studies for future relative comparisons between projects of the PPP procurement route.

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APPENDIX A

FACTORS FROM THE LITERATURE

Table A1: Factors Derived from the Literature

No	Factor	Source
1	A multidisciplinary team responsible for implementation of relationship management principles	Zou et al., 2014
2	Accounting documents are exposed to every member	Aapaoja et al., 2013
3	Attitudes of loyalty, receptivity, and care	Kumaraswamy and Anvuur, 2008
4	Commitment from top management	Ibrahim et al., 2013; Ling et al., 2013; Zou et al., 2014
5	Compatible organizational culture of the involved parties	Kumaraswamy et al., 2005
6	Creation of a co-located team	Aapaoja et al., 2013; Baiden et al., 2006; Ibrahim et al., 2013
7	Creation of a single integrated team	Baiden et al., 2006; Ibrahim et al., 2013
8	Effective management of health and safety	Ibrahim et al., 2013
9	Equal opportunity for project inputs	Aapaoja et al., 2013; Baiden et al., 2006; Ibrahim et al., 2013
10	Equitable team relationships	Aapaoja et al., 2013; Baiden et al., 2006
11	Familiarity/previous relationships among parties	Kumaraswamy et al., 2005
12	Formation of an cross-functional management team with collective responsibility	Ling et al., 2013
13	Innovation and improvement	Ibrahim et al., 2013
14	Long term commitment	Ling et al., 2013
15	Mutual trust and respect	Ibrahim et al., 2013
16	Mutually beneficial outcomes	Aapaoja et al., 2013; Baiden et al., 2006
17	No-blame culture (Focus on solving problems, not on finding out who is guilty)	Aapaoja et al., 2013; Baiden et al., 2006; Ibrahim et al., 2013
18	Open communication	Baiden et al., 2006; Ibrahim et al., 2013; Ling et al., 2013
19	Partnering and negotiation skills	Zhang, 2004(a); Zhang, 2005
20	Previous experience in relational contracting approaches	Kumaraswamy et al., 2005
21	Real gainshare/painshare among contracting parties	Ling et al., 2013
22	Rich experience in international PPP project management	Zhang, 2004(b); Zhang, 2005
23	Seamless operation with no organizational defined boundaries	Aapaoja et al., 2013; Baiden et al., 2006; Ibrahim et al., 2013
24	Sharing risks	Aapaoja et al., 2013

25	Single team focus and objectives	Aapaoja et al., 2013; Baiden et al., 2006; Ibrahim et al., 2013; Ling et al., 2013
26	Strong Inter-personal relations at the individual level	Kumaraswamy et al., 2005; Zhang, 2004(a)
27	Team commitment, honesty, openness and trust	Tang et al., 2012; Zou et al., 2014
28	Unrestricted cross-sharing of information	Aapaoja et al., 2013; Baiden et al., 2006; Ibrahim et al., 2013; Ling et al., 2013
29	Using an integrated ICT system	Ibrahim et al., 2013
30	Willingness/enthusiasm of the parties	Kumaraswamy et al., 2005

Table A2: Factors Developed from IPD Literature

No	Factor	Source
1	Collaborative decision making and control	AIA, 2007
2	Collective risk management	El-adaway et al, 2017; Thomsen et al, 2009
3	Compensation (incentives)	AIA, 2007; El-adaway et al, 2017
4	Core group for project management	El-adaway et al, 2017
5	Early goal definition	AIA, 2007
6	Early involvement of key participants	AIA, 2007; El-adaway et al, 2017
7	Intensified planning	AIA, 2007
8	Internal Dispute Resolution	AIA, 2007; El-adaway et al, 2017
9	Joint coordination and monitoring among contracting parties	El-adaway et al, 2017
10	Multiparty agreement	AIA, 2007; El-adaway et al, 2017
11	Qualified organization and leadership	AIA, 2007
12	Sharing risks and rewards	AIA, 2007; El-adaway et al, 2017
13	Team developed goals	AIA, 2007
14	Trust, fairness, and mutual cooperation	El-adaway et al, 2017
16	Using appropriate technology	AIA, 2007
17	Using BIM (Building Information Modeling)	AIA, 2007; El-adaway et al, 2017
18	Using the Last Planner System	Thomsen et al, 2009
19	Waiver of claims	AIA, 2007; El-adaway et al, 2017
20	Withdrawal	AIA, 2007

APPENDIX B

RESEARCH SURVEY

Research Survey on Project Stakeholder Integration

A) Research Overview

i. This survey is part of a research that explores the integration level of the different stakeholder teams on construction projects. These teams represent the various parties involved in the project (Owner, Engineer, Consultant(s), Contractor(s), Subcontractor(s), etc.).

ii. Stakeholder integration describes a setting where all those teams are working together, in an atmosphere of collaboration, teamwork, trust, information sharing, etc., for the good of the project as a whole. The general idea is that different parties are "integrated" under one umbrella and work towards common goals and objectives.

iii. Collaboration in project delivery can take many forms. Examples of such are: Partnering, working through a Consortium, Joint Ventures, PA (Project Alliancing), and IPD (Integrated Project Delivery), among others.

B) Survey Goal

i. The goal of the survey is to rate certain factors that contribute to team integration in terms of their relative importance.

ii. The criteria will be compared in a pair-wise manner against each other to determine the significance of each in achieving team integration.

C) Survey Structure

• The survey is divided into two sections.

1) The first section addresses general information about the respondent.

2) The second section compares and rates the different integration factors.

There are 14 questions in this survey.

General Information

1. What type of project stakeholder do you work as? *

Please choose **only one** of the following:
- ○ Employer/Developer
- ○ Financing Entity
- ○ Design Consultant
- ○ Project Management Consultant
- ○ Construction Contractor
- ○ Operating Contractor/Service Provider
- ○ Other

2. How many years of experience do you have in your relevant sector? *

Please choose **only one** of the following:
- ○ 0-5 years
- ○ 5-10 years
- ○ >10 years
- ○ Other

3. Have you worked on a project applying any form of collaboration in project delivery (e.g. Partnering, Consortium, Integrated Project Delivery (IPD), Project Alliancing (PA), Joint Venture, etc.)? *

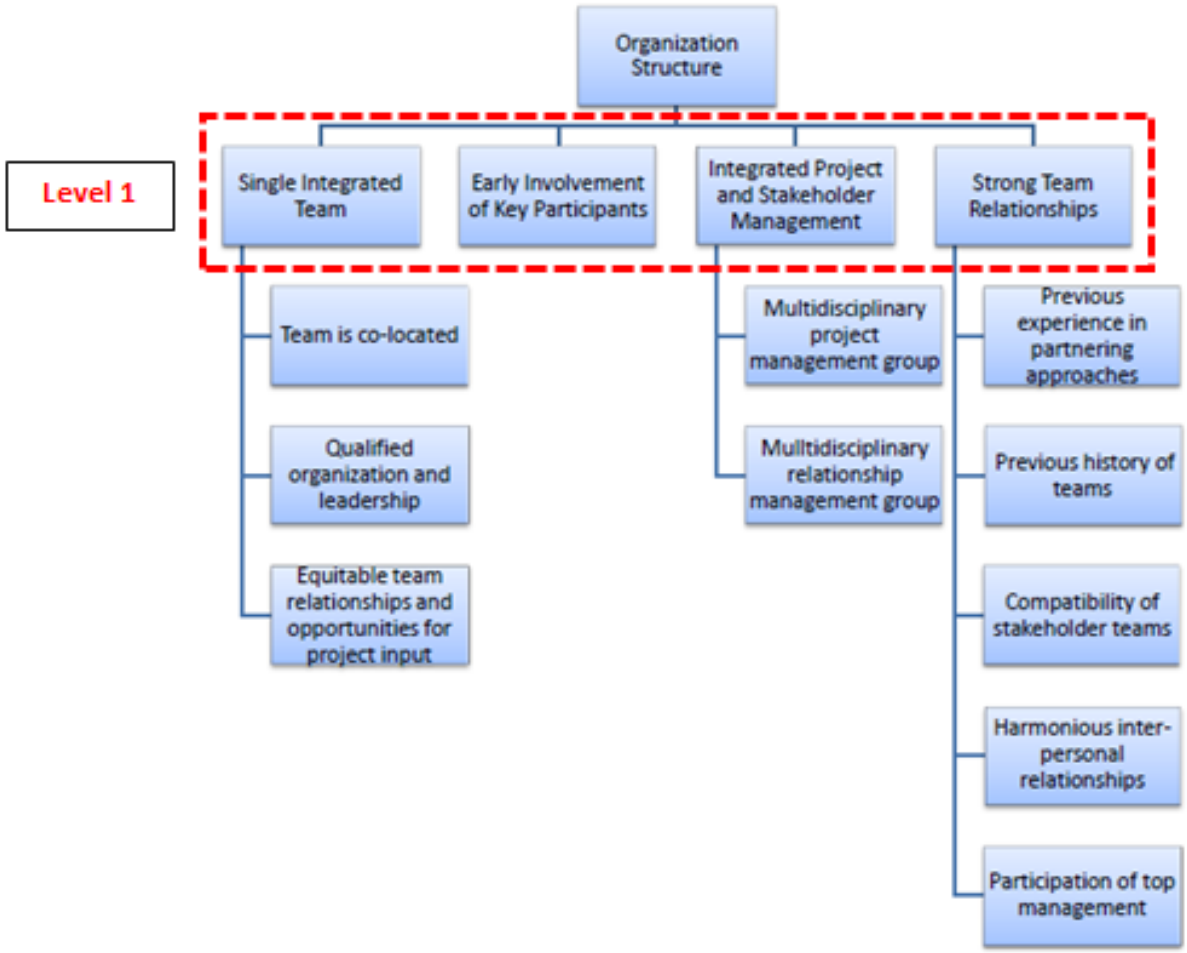
Please choose **only one** of the following:
- ○ Yes
- ○ No

4. What form of approach from the question above have you worked with? *

Please choose **all** that apply:
- ☐ Partnering
- ☐ Consortium
- ☐ Joint Venture
- ☐ Project Alliance
- ☐ Integrated Project Delivery
- ☐ Other:

Factor Set 1: Organization Structures

The figure below presents the integration factors under the **Organization Structures** hierarchy. The factors that will be compared are those under LEVEL 1.



The table below presents 4 factors, along with their respective descriptions.

Please answer the questions below, by first specifying which factor is more important, then writing the number (from 1 to 9), describing the level of importance (As per Table above)

Factor No.	Name	Description
O1	Single integrated team	Combining the different stakeholder teams under one common integrated team.
O2	Early involvement of key participants	Involving key participants early on to receive influential input during the early project stages of decision making.
O3	Integrated project and stakeholder management	Overall project governance and stakeholder management is the responsibility of multidisciplinary teams made of representatives of key project stakeholders.
O4	Strong Team Relationships	Relationships between stakeholder teams are influenced by their experience, previous history together, and compatibility.

	State More Important Factor	Scale of Importance
O1 or O2		
O1 or O3		
O1 or O4		

	State More Important Factor	Scale of Importance
O2 or O3		
O2 or O4		

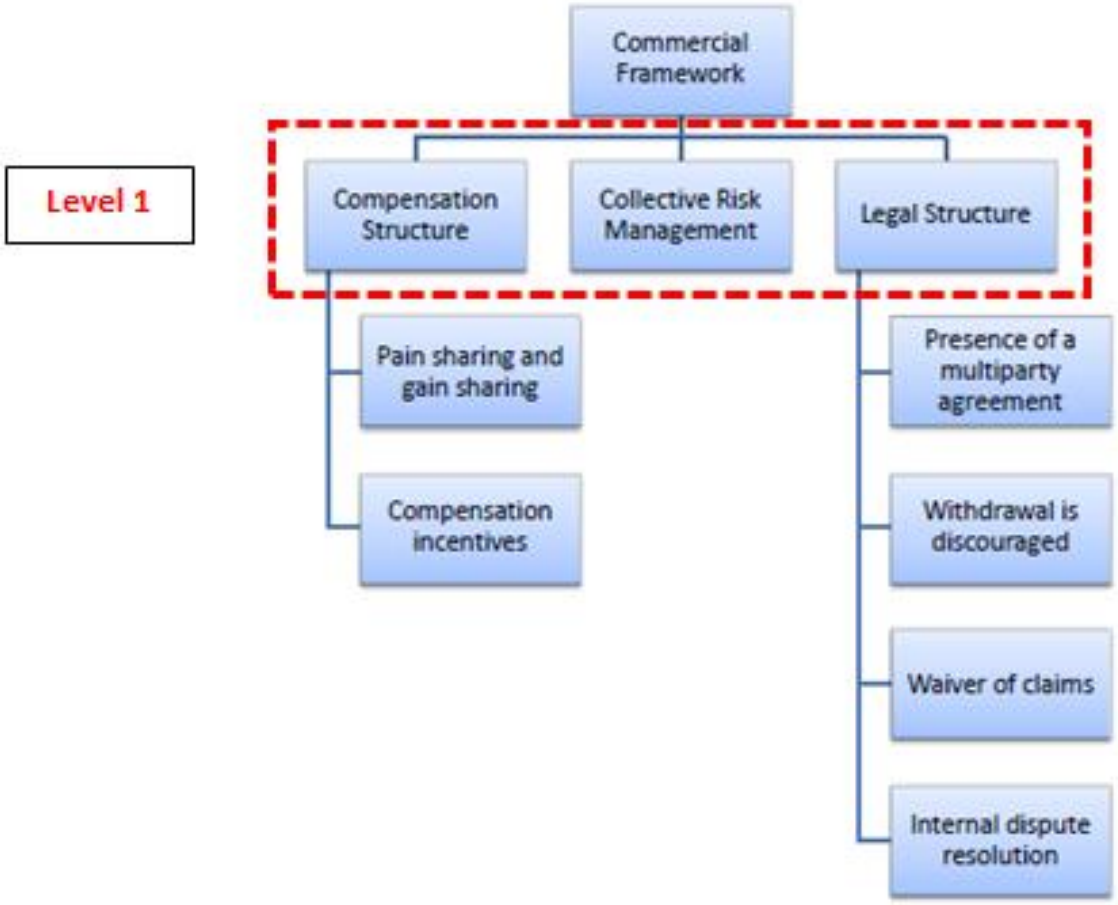
	State More Important Factor	Scale of Importance
O3 or O4		

Kindly adopt the following scale system to answer the questions of the survey.

Scale	**Definition**	**Explanation**
1	Equal importance	Equally-treated criteria
2	Slightly Equal	
3	Moderate Importance	Moderately favor one criteria over the other
4	Moderate plus	
5	Strong Importance	Strongly favor one criteria over the other
6	Strong plus	
7	Very Strong Importance	Very Strongly favor one criteria over the other
8	Very Strong plus	
9	Absolute Importance	Absolutely favor one criteria over the other

Factor Set 2: Commercial Frameworks

The figure below presents the integration factors under the **Commercial Frameworks** hierarchy. The factors that will be compared are those under LEVEL 1.



The table below presents 3 factors, along with their respective descriptions.

Please answer the questions below, by first specifying which factor is more important, then writing the number (from 1 to 9), describing the level of importance (As per Table at the bottom of the page).

Factor No.	Name	Description
C1	Compensation Structure	Compensation is designed in a way to align stakeholder interests with each other, and with project interests.
C2	Collective Risk Management	Project risk is managed collectively by all stakeholders and liability is shared instead of each party only being liable for his own risks.
C3	Legal Structure	Legal structure is designed in a way to drive collaboration between stakeholder teams.

	State More Important Factor	Scale of Importance
C1 or C2		
C1 or C3		

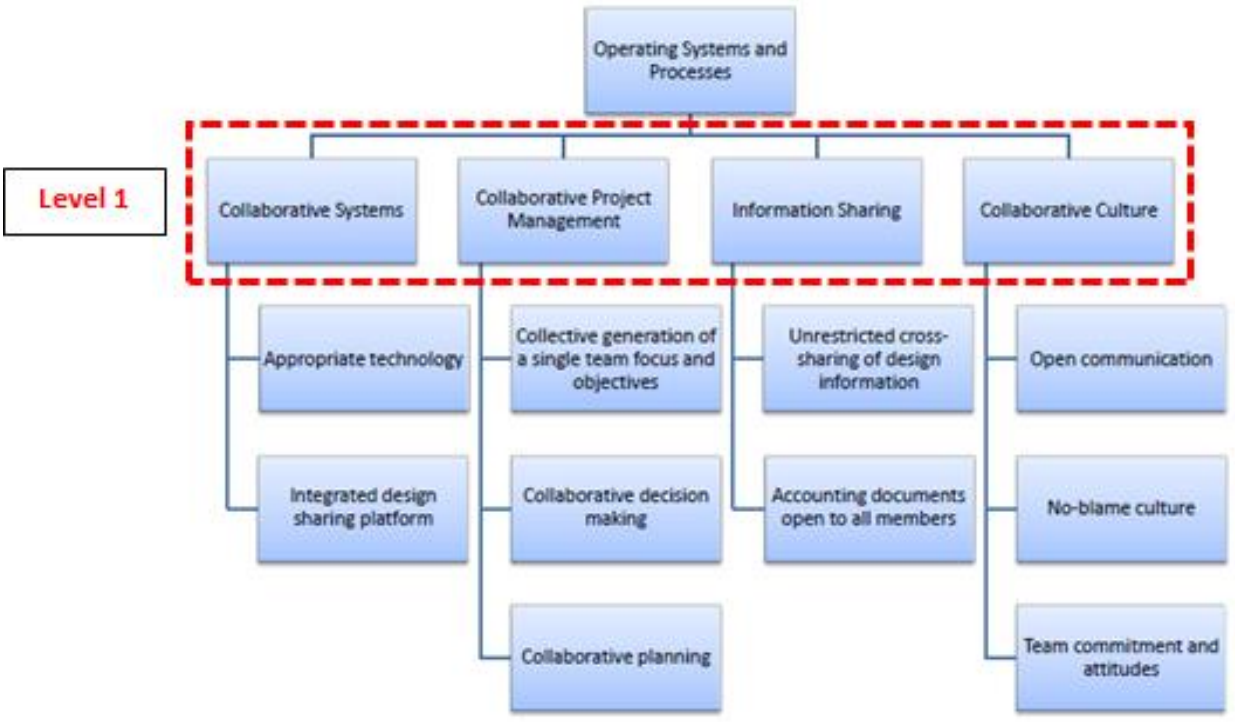
	State More Important Factor	Scale of Importance
C2 or C3		

Kindly adopt the following scale system to answer the questions of the survey.

Scale	**Definition**	**Explanation**
1	Equal importance	Equally-treated criteria
2	Slightly Equal	
3	Moderate Importance	Moderately favor one criteria over the other
4	Moderate plus	
5	Strong Importance	Strongly favor one criteria over the other
6	Strong plus	
7	Very Strong Importance	Very Strongly favor one criteria over the other
8	Very Strong plus	
9	Absolute Importance	Absolutely favor one criteria over the other

Factor Set 3: Operating Systems and Processes

The figure presents the integration factors under the **Operating Systems and Processes** hierarchy. The factors that will be compared are those under LEVEL 1.



The table below presents 4 factors, along with their respective descriptions.

Please answer the questions below, by first specifying which factor is more important, then writing the number (from 1 to 9), describing the level of importance (As per Table at the bottom of the page).

Factor No.	Name	Description
P1	Collaborative Systems	Using operating systems and technologies that support collaboration among stakeholders.
P2	Collaborative Project Management	There is joint coordination, planning, and monitoring of project works among the different stakeholders.
P3	Information Sharing	A setting involving the sharing of project information between the different stakeholder teams.
P4	Collaborative Culture	A prevalent culture that is built on collaboration, teamwork, and trust.

	State More Important Factor	Scale of Importance
P1 or P2		
P1 or P3		
P1 or P4		

	State More Important Factor	Scale of Importance
P2 or P3		
P2 or P4		

	State More Important Factor	Scale of Importance
P3 or P4		

Kindly adopt the following scale system to answer the questions of the survey.

Scale	**Definition**	**Explanation**
1	Equal importance	Equally-treated criteria
2	Slightly Equal	
3	Moderate Importance	Moderately favor one criteria over the other
4	Moderate plus	
5	Strong Importance	Strongly favor one criteria over the other
6	Strong plus	
7	Very Strong Importance	Very Strongly favor one criteria over the other
8	Very Strong plus	
9	Absolute Importance	Absolutely favor one criteria over the other

Final Factor Set

Finally, please rate the relative importance of the 3 broad headings we have defined before:

Please answer the questions below, by first specifying which factor is more important, then writing the number (from 1 to 9), describing the level of importance (As per Table at the bottom of the page).

Factor No.	Name	Description
O	Organization Structures	These factors relate to the organization of the different teams on the project.
C	Commercial Frameworks	These factors relate to the compensation structures, risk management approaches, and legal frameworks on the project.
P	Operating Systems and Processes	These factors relate to the operating systems and technologies used, the project day-to-day management processes, and the project culture.

	State More Important Factor	Scale of Importance
O or C		
O or P		

	State More Important Factor	Scale of Importance
C or P		

Kindly adopt the following scale system to answer the questions of the survey.

Scale	Definition	Explanation
1	Equal importance	Equally-treated criteria
2	Slightly Equal	
3	Moderate Importance	Moderately favor one criteria over the other
4	Moderate plus	
5	Strong Importance	Strongly favor one criteria over the other
6	Strong plus	
7	Very Strong Importance	Very Strongly favor one criteria over the other
8	Very Strong plus	
9	Absolute Importance	Absolutely favor one criteria over the other

APPENDIX C

CASE STUDY CALCULATION WORKSHEET

A- Organizational Structures

Table A1: Calculating factor O1 (Single Integrated Team)

ID	Factor	Grade
O1a	Team is co-located	3
O1b	Qualified organization and leadership	5
O1c	Equitable team relationships and opportunities for project input	3
O1	**Single Integrated Team**	**3.67**

Table A2: Calculating factor O2 (Early Involvement of Key Participants)

ID	Factor	Grade
O2	**Early Involvement of Key Participants**	**4**

Table A3: Calculating factor O3 (Integrated Project and Stakeholder Management)

ID	Factor	Grade
O3a	Multidisciplinary project management group	3
O3b	Multidisciplinary relationship management group	4
O3	**Integrated Project and Stakeholder Management**	**3.5**

Table A4: Calculating factor O4 (Strong Team Relationships)

ID	Factor	Grade
O4a	Previous experience in partnering approaches	5
O4b	Previous history of teams	1
O4c	Compatibility of stakeholder teams	4
O4d	Harmonious inter-personal relationships	5
O4e	Participation of top management	4
O4	**Strong Team Relationships**	**3.33**

Table A5: Calculating factor O (Organization Structures)

Factor	Description	Grade
O1	Single Integrated Team	3.67
O2	Early Involvement of Key Participants	4
O3	Integrated Project and Stakeholder Management	3.5
O4	Strong Team Relationships	3.33

$$Integration\ Level\ (O)\ = 0.247 \times O1 + 0.251 \times O2 + 0.250 \times O3 + 0.252 \times O4$$

$$Integration\ Level\ (O)\ = 3.62$$

B - Contractual Frameworks

Table B1: Calculating factor C1 (Compensation Structure)

ID	Factor	Grade
C1a	Pain sharing and gain sharing	4
C1b	Compensation incentives	3
C1	**Compensation Structure**	**3.5**

Table B2: Calculating factor C2 (Collective Risk Management)

ID	Factor	Grade
C2	**Collective Risk Management**	**3**

Table B3: Calculating factor C3 (Legal Structure)

ID	Factor	Grade
C3a	Presence of a multiparty agreement	5
C3b	Withdrawal is discouraged	3
C3c	Waiver of claims	5
C3d	Internal dispute resolution	5
C3	**Legal Structure**	**4.33**

Table B4: Calculating factor C (Contractual Frameworks)

Factor	Description	Grade
C1	Compensation Structure	3.5
C2	Collective Risk Management	3
C3	Legal Structure	4.33

$$Integration\ Level\ (C)\ = 0.561 \times C1 + 0.223 \times C2 + 0.216 \times C3$$

$$Integration\ Level\ (C)\ = 3.57$$

C - Operating Systems and Processes

Table C1: Calculating factor P1 (Collaborative Systems)

ID	Factor	Grade
P1a	Appropriate technology	3
P1b	Integrated design sharing platform	2
P1	**Collaborative Systems**	**2.5**

Table C2: Calculating factor P2 (Collaborative Project Management)

ID	Factor	Grade
P2a	Collective generation of a single team focus and objectives	3
P2b	Collaborative decision making	3
P2c	Collaborative planning	2
P2	**Collaborative Project Management**	**2.67**

Table C3: Calculating factor P3 (Information Sharing)

ID	Factor	Grade
P3a	Unrestricted cross-sharing of design information	5
P3b	Accounting documents open to all members	3
P3	**Information Sharing**	**4**

Table C4: Calculating factor P4 (Collaborative Culture)

ID	Factor	Grade
P4a	Open communication	3
P4b	No-blame culture	3
P4c	Team commitment and attitudes	2
P4	**Collaborative Culture**	**2.67**

Table C5: Calculating factor P (Operating Systems and Processes)

Factor	Description	Grade
P1	Collaborative Systems	2.5
P2	Collaborative Project Management	2.67
P3	Information Sharing	4
P4	Collaborative Culture	2.67

$$Integration\ Level\ (P)\ = 0.135 \times P1 + 0.361 \times P2 + 0.297 \times P3 + 0.207 \times P4$$

$$Integration\ Level\ (P)\ = 3.04$$

D - Project Integration Level

$$Overall\ Project\ Integration\ Level\ = 0.373 \times O + 0.432 \times C + 0.195 \times P$$

$$Overall\ Project\ Integration\ Level\ = 3.49$$

E – Sensitivity Analysis

Factor	o1	o2	o3	o4	c1	c2	c3	p1	p2	p3	p4
Coefficient	9.21	9.36	9.33	9.40	24.24	9.63	9.33	2.63	7.04	5.79	4.04
-5%	8.75	8.89	8.86	8.93	23.02	9.15	8.86	2.50	6.69	5.50	3.83
+5%	9.67	9.83	9.79	9.87	25.45	10.12	9.80	2.76	7.39	6.08	4.24
Rating	3.67	4.00	3.50	3.33	3.50	3.00	4.33	2.50	2.67	4.00	2.67
-5%	3.48	3.80	3.33	3.17	3.33	2.85	4.12	2.38	2.53	3.80	2.53
+5%	3.85	4.20	3.68	3.50	3.68	3.15	4.55	2.63	2.80	4.20	2.80
Integration Level	3.49										
-5%	3.15										
+5%	3.84										