ANALYZING THE APPLICATION OF INTEGRATED PROJECT DELIVERY FOR THE ZAMBIAN CONSTRUCTION INDUSTRY

By

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A dissertation submitted to the University of Zambia in partial fulfilment of the requirements for the award of Master of Engineering Degree in Construction Management

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DECLARATION

I, **Kabemba Ngoy Steve,** hereby declare that the work presented in this dissertation is the result of my research work and that it has never been produced or submitted before at this University for academic purposes, and that all sources of information have been duly acknowledge.

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The University of Zambia approves this dissertation of Kabemba Ngoy Steve entitled "**Analyzing the Application of Integrated Project Delivery for the Zambian Construction Industry**" as fulfilling the partial requirements for the award of the Master of Engineering degree in Construction Management.

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DEDICATION

In memory of my father Ngoy Kabemba Baudouin.

To my aunty Elisabeth Tshisumbule who continues to show me so much love and whose guidance, advice and encouragement have brought me here.

To my mother Nkusu Tshisumbule Agnes who has not ceased to express love, tenderness and patience in my moral and intellectual growth.

To the triumph of love and appreciation I have for myself.

I dedicate this work.
Steve KABEMBA NGOY

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Finally, I express a warm and sincere thanks to the people who assisted and contributed ideas and advices, mainly classmates and those who comfort me, Christian Mulembo and his family; Meschack Bambala; Marie Michelle Bambala; Nicole; Carole; Yves; Esther; Gaius NGOY my brothers and sisters.

ABSTRACT

The construction industry is an important sector in the economies of nations and plays a key role in socio-economic growth of Zambia. Construction projects in Zambia fail to meet owner's performance expectations. Increased cost-effectiveness and reduced waste in Architecture, Engineering and Construction (AEC) projects requires an examination of alternative delivery methods. Integrated Project Delivery (IPD) has been used on some projects since 2007, revealing great advantages and outcomes exceeding owner's expectation. IPD is a proven solution for a poorly structured construction industry characterized by wastage, late-delivered projects, over budget, and at a significant human cost. Yet, the exposition, understanding and application of IPD mechanism in Zambia remains absent in the construction project management, specifically in the construction practitioner's human skills. The purpose of this paper was to examine whether IPD is the appropriate delivery method for the Zambian Construction Industry. The investigation used a mixed method through a case study analysis and a questionnaire targeting construction practitioners in the Zambian construction industry. The finding shows that the most influential driver of IPD principles is a signed agreement of the multi-party contract which gives details concerning the implementation of IPD practices such as big room concept, alignment of interest, and gain and pain sharing. It also shows that 87.4% of respondents agreed with statements coming from the IPD main contract while 12.6% either disagreed or were unsure, 69.8% were in agreement with IPD catalysts while 29.2% of respondents were unsure on the usefulness of the suggested tools to deliver project more effectively and finally 97.9% of respondents perceived that the adoption and application of IPD principles in the Zambian construction industry would help deliver efficient projects in Zambia. Hence the need for familiarize construction practitioners with IPD contractual principles.

Keywords: *Integrated Project Delivery, Collaboration, Delivery method, Zambian Construction Industry.*

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ABBREVIATIONS

ACEZ	Association of Consulting Engineers of Zambia
AGCA	Associated General Contractors of America
AIA	American Institute of Architect
ASU	Arizona State University
BIM	Building information modeling
CII	Construction Industry Institute
CMAR	Construction Management at Risk
DB	Design-build
DBB	Design-Bid-Build
EIZ	Engineering Institution of Zambia
GDP	gross domestic product
GMP	preliminary Guaranteed Maximum Price
HVAC	Heating, ventilation, and air conditioning
IFOA	Multi-Party Agreement based on Sutter Health
IPD	Integrated Project Delivery
JIT	Just in Time
LCI	Lean Construction Institute
LEED	Leadership in Energy and Environmental Design
MEP	The Mechanical, Electrical and Plumbing
MSMEs	Micro, Small, and Medium Enterprises
NCC	National Council for Construction
NIST	National Institute of Standards and Technology
PIT	Project Implementation Team
RO	Research Objective
SIZ	Surveyors Institute of Zambia
SMT	Senior Management Team
SPSS	Statistical Packages for Social Science
TQC	Total Quality Control
USA	United State of America
ZCI	Zambian Construction Industry

ZIA	Zambia Institute of Architects
ZPPA	Zambian Public Procurement Authority

CHAPTER ONE: INTRODUCTION

1.1 Background

The construction industry is an important sector in the economies of nations and plays a key role in their socio-economic growth. This is accomplished through the creation of jobs and the establishment of infrastructures. In all countries, the construction industry has close links with various sectors of the economy. It forms a large part of the economy of every country and accounts for between 10 percent on average of gross domestic product (GDP) (Lopes, 2012).

The majority of population in sub-Saharan Africa has little or no access to safe drinking water, adequate housing, health and education services (Zawdie & Langford, 2000). The persistence of this problem is directly related to the lack of adequate infrastructure, and the prevalence of low indigenous construction capacity in the region. To mitigate these problems for sustainable development, a wide range of initiatives in the construction sector should be explored. According to O'Connor(2007) there is too little investment in innovation, technology, training, and education in the construction sector more than is commonly thought.

The construction industry contributes 19 percent of the national GDP while growing, year-on-year, faster than the already rapidly expanding Zambian economy (Zambia Green Jobs Program, 2012). The same report concludes that, the sector offers excellent potential for broad-based wealth and job creation, due to its labor intensity, low entry barriers for semi-skilled and unskilled labor, and high concentration of micro, small, and medium enterprises (MSMEs). Zambia construction Industry (ZCI) plays an integral part in the development of the economy and has been one of the important catalysts for growth in recent years (Mukelabai, 2016). Activity in the sector is driven by public and private projects such as roads, stadium, residential and commercial property. Although construction is one of Zambia's fastest growing sectors, it ranks near the bottom of all employment sectors in terms of wages, proportion of permanent employees, social protection awareness and unionized staff, it also has inherent occupational safety and health risks (Mukelabai, 2016).

The National Council for Construction (NCC) a statutory body charged with the responsibility of regulating the ZCI. The NCC (2006) reported that, the construction industry in Zambia is characterize with contractors abandoning the workmanship on site, poor and insufficient supervision of consultants. What is even more worrying about the above negative phenomenon is that Zambian society seems to have lost all confidence in its own local contractors. In fact, there are "*bad eggs*" among Zambian contractors, just like "*bad eggs*" among foreign contractors, although small in number contrary to the impression given in the press (NCC, 2006). The apparent loss of confidence of Zambian society, including the government itself, its due to the fact that foreign entrepreneurs continued to obtain construction contracts at the expense of local entrepreneurs (Simumba, 2018).

As a result of points raised above, it is necessary to modify some practices in the construction sector. Projects are always delivered in the traditional delivery method or it variants. The traditional method is structured in the way that, the employer, the designers, and contractors work as a team but separated and where conflicts are inherent. This is happening because of different perceptions of how these factors of their relationship interact.

The Integrated Projects Delivery (IPD) seems to be a solution for future construction project in terms of efficiency and new collaborative structure that it offers (University of Minnesota, 2012). In 2016 according to Deloitte Africa's construction industry report, most African countries spent a lot of money in the construction related matter, and in 2017 an economic growth of over 5 percent in the construction industry was expected (Deloitte, 2016). This expectation was based on a number of observation that occurred or were likely to occur in 2017. From this trend, the Deloitte (2017) report, asserts that collaborative project delivery methods will become more popular in the following years as the days of traditional delivery method domination might be winding down in the world.

IPD is a project delivery approach that integrates people, systems, business, structures and practices into a process that collaboratively harness the talents and insights of all participants to reduce waste and optimize efficiency through all phases of design, fabrication and construction (Cook, 2007). IPD offers a different approach to any other

delivery method in the construction industry. Leading proponents of IPD claim that it can potentially achieve superior results over other procurement models. The required commitment from all parties and team members is to see the project succeed and the contractual relationships that bind the parties requires a team culture based on risk-sharing, joint decision making and trust, like no other.

Change is sometimes motivated by discontent with the status quo, because the projects that have been delivered so far have not met expectations, this justifies the ideology proposed by IPD. Thus in 2007, two professional institutions, The American Institute of Architect (AIA) and the Associated General Contractors of America (AGCA) agreed to publish the IPD standard contract form called ConsensusDOCS300. The ConsensusDOCS300 describes the rights and obligations of the contacting parties and the agreed procedures for the administration of their contract. The ConsensusDOCS300 document was developed through a collaborative effort of entities representing a wide cross-section of the construction industry (AIA, 2007).

This study analyzes the application of the IPD for the ZCI. Studying the implementation process of a range of projects which have used IPD as a delivery method by documenting how IPD has been adapted to face the challenges of the traditional delivery method. By analyzing the application of this collaborative approach and examining the perception of Zambian construction practitioners, a new contractual structure and management formula can be put in place in ZCI to attain change in the procurement strategies in order to deliver projects efficiently.

1.2 Problem Statement

Today, construction projects are subject of more demands than any other time in history (Hanks, 2015). Competition has forced contractors to submit projects with minimal benefits in order to stay in business. In addition to their multi-stakeholder nature, projects are becoming more and more complex and risky. This has compounded the burden on contractors to build increasingly sophisticated and risky projects with fewer resources and profits. It is therefore not a surprising that the number of claims, dispute and litigation reported within the construction sector continues to increase (Zaneldin, 2005).

The problems of the construction industry are many and varied. Among the problems that can be identified is the lack of innovation in the form of reactive and flexible delivery method (O'Connor, 2007). A study by the United State Bureau of Labor shows that productivity in the construction industry has declined since 1964, while all other non-farm industries increased by nearly 200 percent (Kenig, 2010). In the same vein, another institution stated three years later that, the design and the construction industry may be one of the most dysfunctional major industry in the economy and the only one that has lost productivity in the last 30 years (NIST, 2013). A 2010 study by the National Institute of Standards and Technology (NIST) shows that the lack of software interoperability costs the industry nearly USD 16 million a year (Kenig, 2010). The 2004 study on the industrial construction industry by Lean Construction Institute (LCI) conclude that, up to 57 percent of the time, effort and material investment in construction projects adds no value to the final product, compared to only 26 percent in the manufacturing world.

Jackson (2010) asserts in her report that 30 percent of construction projects do not make schedule or budget, 92 percent of project owners say, architectural drawing are not sufficient, and 37 percent of all construction materials go to waste. This contributes to making the construction industry less and less productive. The source of this inefficiency is the division between the design and construction industries and the difficulty of communication between the contractors, the consultant and the owner (Prince, 2014). This happens simply because of the adversarial relationship which implicate practices that are not project centered.

In 2015, the Zambian Parliament reported on the challenges that hinder local contractors from participating in the construction industry effectively. The document basically stated that limited technical and managerial skills was one of the major challenges faced by local contractors. Limited technical and managerial skills include lack of familiarity with the work and subtleties of the industry; with various tools and techniques for planning; control of construction operations; and the personality insight that allowed them to work harmoniously with others, often in very difficult circumstances. The above results show that the ZCI is not excluded, and has to face challenges that reduces its productivity.

1.3 Aim of the Research

The aim of this study is to ascertain whether IPD is the appropriate delivery method for ZCI.

1.4 Objectives of the Study

The overarching objectives of this study are to:

1. Examine the particular type of contract agreement used by IPD;
2. Identify and analyze the basic principles of IPD;
3. Examine the perception of Zambian construction practitioners' on IPD principles;
4. Recommend the application of IPD principles in ZCI.

1.5 Research Questions

The research questions formulated for this study are as follow:

i. Which type of contract does IPD use?

ii. What is the collaboration structure used in IPD?

iii. How is the multi-party IPD agreement implemented?

iv. What is the perception of Zambian construction practitioners toward IPD principles?

1.6 Methodology of the Study

The approach used in this study to ascertain whether IPD is the appropriate delivery method for ZCI was both quantitative and qualitative. The qualitative methodology explored and explained project that have used the IPD in its pure form while the quantitative methodology was used to investigate and analyze whether IPD is appropriate for the ZCI.

1.7 Data Collection

Data were collected in two phases, primary data and secondary data.

1.7.1 Primary Data Collection

The primary data collection was based on an applicability study of the IPD as a delivery method in the particular environment of ZCI using a survey questionnaire addressed to construction practitioners.

1.7.2 Secondary Data Collection

The secondary data collection was based on the examination of practices and principles of IPD as a delivery method. It was done through a document review, using a multiple case study analysis to describe thoroughly the implementation of IPD as a delivery method and its impact on the result of a construction project.

1.8 Significance of the Study

One of the major decision when engaged in a construction project is to determine the delivery method, and this decision is often the responsibility of the owner. Selecting the best method for any project must begin with a good understanding of the choices available and the implications of each one of them on the project outcome.

The results of this study will help Zambian construction practitioners consider the option offered by the IPD when selecting a delivery method for their projects. These considerations are related to a realistic budget, a timetable that includes a reasonable performance period, a reactive and quality design process, a risk assessment with risk allocation for the appropriate parties and recognition of the level of expertise within the organization of the parties (Rawlins, 2015). The study also give an understanding of IPD principles, practices as well as the heart of its contractual relationship; cost, quality and time management.

1.9 Limitation

The results of this research are limited to ZCI. The research explores, and describes IPD through a multiple case study analysis and a survey questionnaire to construction practitioners in order to assess the practicability of IPD principles in Zambia. The research faced some unescapable limitations. The first one is the limitation relating to time. The research was conducted on a small scale of targeted construction professionals who were able to give adequate answers and on time. The second issue was due to a lack of research on IPD. IPD is a new delivery method which has not been used very much in the world. Despite these limitations the research aim was achieved, be it with challenges.

1.10 Organization of the Dissertation

This research contains six chapters:

Chapter One presents the background of the study by detailing the problem statement, the aim of the study, the research objectives, research questions as well as the significance of the study.

Chapter Two discusses the literature review written on the IPD by giving a detailed description of IPD, why traditional delivery method is falling to give desired outcomes and how IPD structure can be considered as a solution for future by delivering efficient construction projects.

Chapter Three discusses the methodology used to undertake this research by detailing the research philosophy, the research design, the data collection methods and the instruments used. It has also discussed the data analysis approach.

Chapter Four analyzes IPD case studies, by focusing on the background of the project analyzed, the strategy used to implement IPD and concluded with lessons learnt.

Chapter Five presents' findings relating to the survey and discusses these results by contrasting them to the arguments contained in the literature review and the analyzed case studies.

Chapter Six concludes this study by showing how research objectives were met and gives a set of recommendations for ZCI.

1.11 Summary

This chapter presented the background to the study, by outlining briefly causes for a need for change in the construction industry and the necessity to explore and embrace a new collaborative approach like IPD in Zambia. The chapter also gave the direction taken by the study by highlighting the aim of the study, the main objectives, the research questions, the methodology used to collect data and the significance of the study. The following chapter presents the literature review by other authors on the IPD, showing what has been done in order to identify the gap to be filled by this research.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

The previous chapter presented the background to the study explaining briefly why the construction industry is in the current state, and how answers to the research questions can solve some fundamental problems in the Zambian construction industry (ZCI). This chapter presents the literature review which shows that past studies are primarily focused on the comparison of IPD and the traditional delivery method, the need for change in the construction industry and the level of collaboration when using the team work approach (Keith, 2010) (O'Connor, 2009). Others scholars focused on the efficiency, cost saving, risk management and the respect of schedule that can produce the IPD approach (Hanks, 2015) (AGCA, et al., 2010). Some reported the success of real-world construction projects that have used the IPD in its pure form in order to understand the mechanism (El-adaway, 2010) (Markku & Cheng, 2016) (Cohen, 2010) (University of Minnesota, 2012). Their conclusions were based on the opinions of direct participants to the IPD construction project

2.2 The Origins of IPD

The Lean Construction Institute (LCI), a coalition of academics, consultants, major software vendors and sub-contractors from different disciplines based in Southern California, appears to be a key point for the transfer and diffusion of this philosophy in the construction sector. Koskela (1992) describes these collaborative methods as coming from the Toyota production system developed in Japan in the 1950s. More specifically, the genealogy of these collaborative methods can be related to the production concepts of Just in Time (JIT) and Total Quality Control (TQC) (Koskela, 1992). In addition, many of the early IPD documents appear to have emerged from LCI via its newspaper (Matthews & Howell, 2005). LCI co-founder asserts that the IPD name is a registered trademark in the United States and the term was first used by Owen Matthews of Westbrook Air Conditioning in Orlando, Florida well before 2005 (Lean Construction Industry, 2016).

2.3 Definition of IPD

Cook (2007) defines IPD as "*a project delivery approach that integrates people, systems, business, structures and practices into a process that collaboratively harness the talents and insights of all participants to reduce waste and optimize efficiency through all phases of design, fabrication and construction*". (Cook, 2007)Many variants of this definition have been formulated for IPD, however, the definition that often comes up in different publications come from the American Institute of Architect (AIA) California Council reported above by Cook. Other researchers' definitions do not contradict the AIA definition but are focused on other aspects. O'Connor's (2009) report on IPD through new collaboration and contract form, describes IPD as holding the prospect of real productivity gains in the provision of design and construction services. For Ballobin (2008), "*IPD is a revolutionary process that offers waste reduction and optimized efficiency throughout the design and construction phases of the building. These attributes are particularly important for customers, but also favorable for designers and contractors because they encourage a reduction of disputes. Since contractors are responsible for about two-thirds of all claims against design firms, designers should greatly benefit from the reduction IPD has to offer.*" This description highlights the benefits that the IPD provides to key stakeholders involved in the project. It shows that claims and litigation can be handled well with IPD.

The second version of the IPD guide define it as "*a project delivery method that is distinguished by a contractual agreement between a minimum of owner, professional designer and contactor where the risk and reward are shared and the success of the stakeholders depends on the success of the project"* (Cohen, 2010). Here, the focus is on the participant, risk sharing and reward to the project stakeholders. Gregory's (2011) report sees in the IPD approach the potential of a future main delivery structure, according to him "*The IPD is perhaps the most exciting innovation for the design and construction industry for decades. With the potential for significant savings and efficiencies not experienced with traditional delivery methods, and the attractiveness of a collegial, collaborative environment. IPD could become the leading method of delivery in the construction industry*".

2.4 Collaboration and IPD

Nowadays division of responsibilities in the construction industry provide that architects and engineers are mostly responsible for planning and design phase, contractors are responsible for the construction phase, and owners are responsible for the results. Nadav et al. (2015) mentioned that this approach works very rarely to create an optimized building as a system, and most often the end product underperforms and may not even meet the needs of stakeholders. Thus, a collaborative contract must create a regime in which risk is shared rather than simply allocated (Tang, et al., 2006), because risk allocation, even carefully done, does not prevent at 100 percent unwanted protective and defensive attitudes.

Lack of effective collaboration is one of the problems faced by the construction industry today. Teamwork has long been recognized as important for the improvement of the quality of services in the construction industry. The Construction Industry Institute (CII) (1990) conducted a comprehensive project management study, examining more than 190 critical factors for the success of projects. 650 people were involved, the study covered various types of projects with construction as final product. The strongest determinant of success, however, were factors relating to coordination and relationships, not technicality. Briefly, the main factor was collaboration.

The Associated General Contractors of America (AGCA) defines collaboration as "*an attempt to establish working relationships between the parties through a formal strategy of mutually developed engagement and communication*" (Levin, 1998). Collaboration strives to create an environment where trust and teamwork preclude disputes, claims, finger pointing, and culpability culture. It emphasizes on cost transparency, risk-sharing approach, cooperative relationship for the benefit of each participant and facilitates the completion of a successful project.

The O'Connor (2009) study concludes that "*teamwork produces optimal results in almost all areas of human activity. Military commitments, marketing campaigns, and sports competitions all depend on tightly coordinated teamwork, and not working as a team often leads to failure or worse.*" Nadav et al. (2015) gave an overview on the collaboration in the construction industry, according to him, over the years, they are different approaches that have been developed to help building professionals execute construction project more

collaboratively such as Partnering, Integrated Design Process; Lean Design and Construction; Integrative Process; and Integrated Project Delivery.

2.4.1 Type of IPD Collaboration

The common answer coming from construction practitioners when they are asked about the use of collaboration in their projects is "*Haven't already been doing collaboration? The answer to this question is probably yes, to a certain extent, many have been using collaborative teams in their past experience. Construction practitioners who gave this answer have been certainly using collaborative contracts, practices and principles such as early involvement of entrepreneurs; contractual incentive provisions (shared savings clauses); preliminary Guaranteed Maximum Price (GMP) targets established during design; and other practices and behaviors*" (Cheng, 2012). Construction practitioners who have discovered the concept of IPD and who have also been involved in collaborative projects using practices that are now described as "*integrated practice*" often feel that they have been using IPD for years. Kenig (2010) asserts that, rather than debating this point, it is probably easier to agree and acknowledge that, to varying degrees, many have been using IPD practices for years. Based on these arguments, the AIA (2010) report distinguished two types of IPD collaboration:

- IPD as a philosophy;
- IPD as a delivery method.

a. IPD as a Philosophy

Which goes by many names in the construction industry such as:

- IPD Lite;
- IPD ish;
- Non Multiparty IPD;
- Hybrid IPD.

IPD as a philosophy occurs when integrated practices or philosophies are applied to more traditional delivery approaches such as Construction Manager at-Risk, Design Build or Design-Bid-Build where there is no multi-party contract (NAFSA, et al., 2010).

b. IPD as a Delivery Method

Which goes by many names in the construction industry such as:

- Multi-Party Contracting;
- Lean Project Delivery;
- Pure IPD;
- Relational Contracting;
- Alliancing.

IPD as a Delivery Method (True IPD or Multi-party contracting) is when the owner has elected to sign a multi-party contract with the prime designer, contractor and/or other key members of the project team (NAFSA, et al., 2010). The main difference between the two remains the binding part.

2.4.2 Levels of Collaboration in IPD

The three level of collaboration structured by the AIA (2010) report, where the above described types of IPD rely on are as follows:

- ✓ Level One – Typical; collaboration not contractually required Figure 2.1
- ✓ Level Two – Enhanced; some contractual collaboration requirements Figure 2.1
- ✓ Level Three – Required; collaboration required by a multi-party contract Figure 2.1

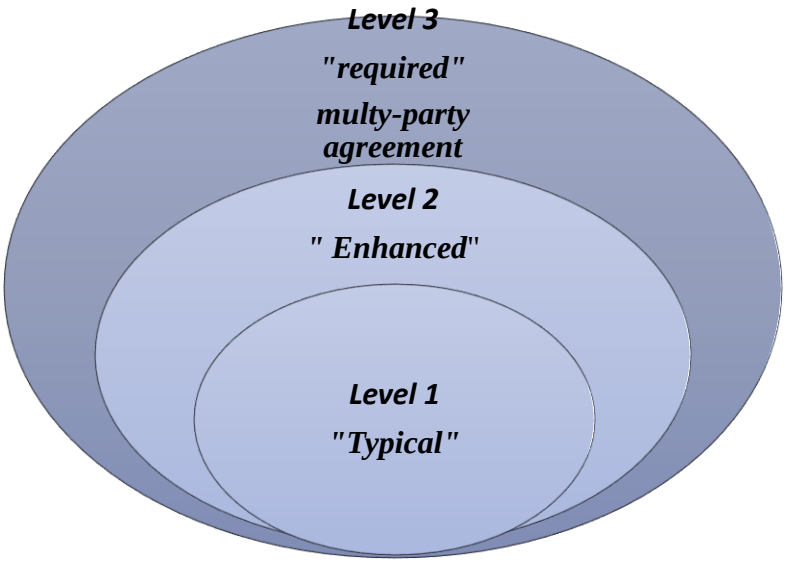

Figure 2.1: IPD, level of collaboration (NAFSA, et al., 2010)

Figure 2.1 illustrates the levels of collaboration in IPD as described above. Level 3 is considered to be the top level of collaboration where an agreement is signed between the keys stakeholders of the project. In the same vein Table 2.1 gives more details on level of collaboration.

Table 2.1: Corresponding delivery approach for the level of collaboration (AGCA, et al., 2010)

	Level 1 "Typical"	**Level 2 "Enhanced"**	**Level 3 "Required"**
Level of Collaboration	lower ⟷ higher		
Philosophy or delivery method?	IPD as a Philosophy	IPD as a Philosophy	IPD as a Delivery Method
Also known as...	N/A	IPD-ish; IPD Lite; Non Multi-party IPD; Technology Enhanced Collaboration; Hybrid IPD; Integrated Practice	Multi-Party Contracting; "Pure"IPD; Relational Contracting; Alliancing; Lean Project Delivery System
Delivery Approaches	CM at-Risk or Design-Build	CM at-Risk or Design-Build	**Integrated Project Delivery**

Table 2.1 gives the corresponding delivery method at each level of collaboration. IPD as a philosophy (Non-multi-party contracts or Levels 1 or 2), IPD as a delivery method (Multi-party contracts or Level 3).

2.5 IPD Project Participants

In terms of project participants, the Commission for Environmental Cooperation presents the structure of the main potential participants for an IPD project in Figure 2.2.

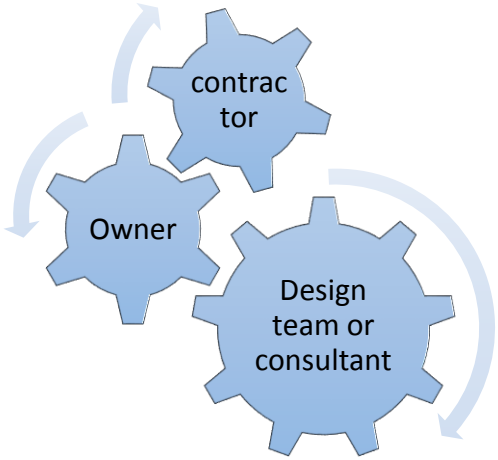

Figure 2.2: Main potential participants in the IPD (Commission for Environmental Cooperation, 2015)

With the following breakdown:

Designer Team

- Day lighting/Energy Analyst
- Commissioning Agent
- Landscape Architect
- Civil Engineer
- Planner
- Architect
- Structural Engineer
- Mechanical, Electrical, Plumbing (MEP) Engineer

Owner

- Building Users
- Owner

- Community Members
- Facilities Manager
- Planning Staff
- Operations and Maintenance Staff

Contactor

- Cost Estimator
- Mechanical, Electrical, Plumbing (MEP) Contractor
- General Contractor
- Construction Manager
- Product Manufacturers

2.6 Distribution of IPD Projects in the World

IPD philosophy is not new, this concept has been around for a longtime but was not used that much. In January 2016, The LCI (2016) release a report which shows the distribution of projects having IPD as a delivery method in the world Figure 2.3.

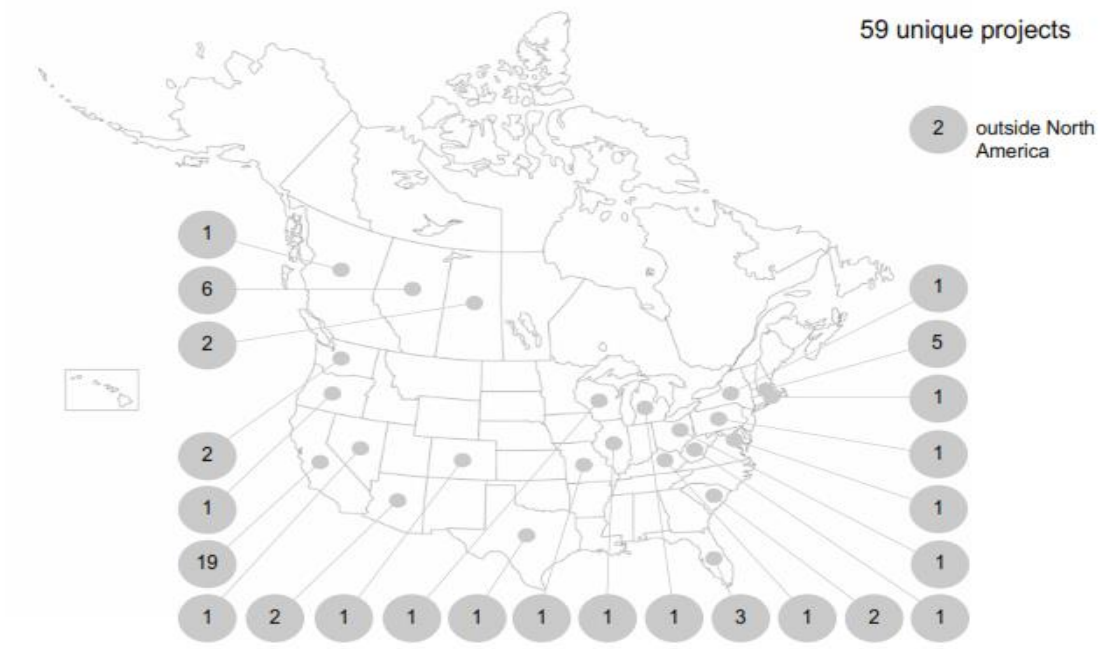

Figure 2.3: IPD map in the world (Lean Construction Industry, 2016)

With the following breakdown:

Table 2.2: Breakdown of IPD project in the world (Lean Construction Industry, 2016)

Unique projects	***59***
• U.S.A	*48*
• Canada	*9*
• Outside of North America	*2*
Project Types	
• Education (K-12)	*1*
• Education (college/university)	*5*
• Health Care	*28*
• Cultural	*1*
• Recreational	*1*
• Office	*5*
• Industrial	*3*
• Mixed Use	*3*
• Government/Civic	*3*
• Single Family Residential	*1*
• Multi-Family Residential	*1*
• Utilities Power/Water/Sewer	*2*
• Other	*5*
Project Scopes	
• Under $10M	*15*
• $10M to $25M	*16*
• $25M to $50M	*7*
• Over $50M	*21*
Project Status	
• Design	*12*
• Construction	*9*
• Complete	*38*

As shown in Table 2.2 the concentration of IPD projects are in the USA, and only two outside North America. The USA construction industry appear to be the first one to apply the philosophy and structure of IPD in its pure form, Figure 2.4 shows IPD map in USA.

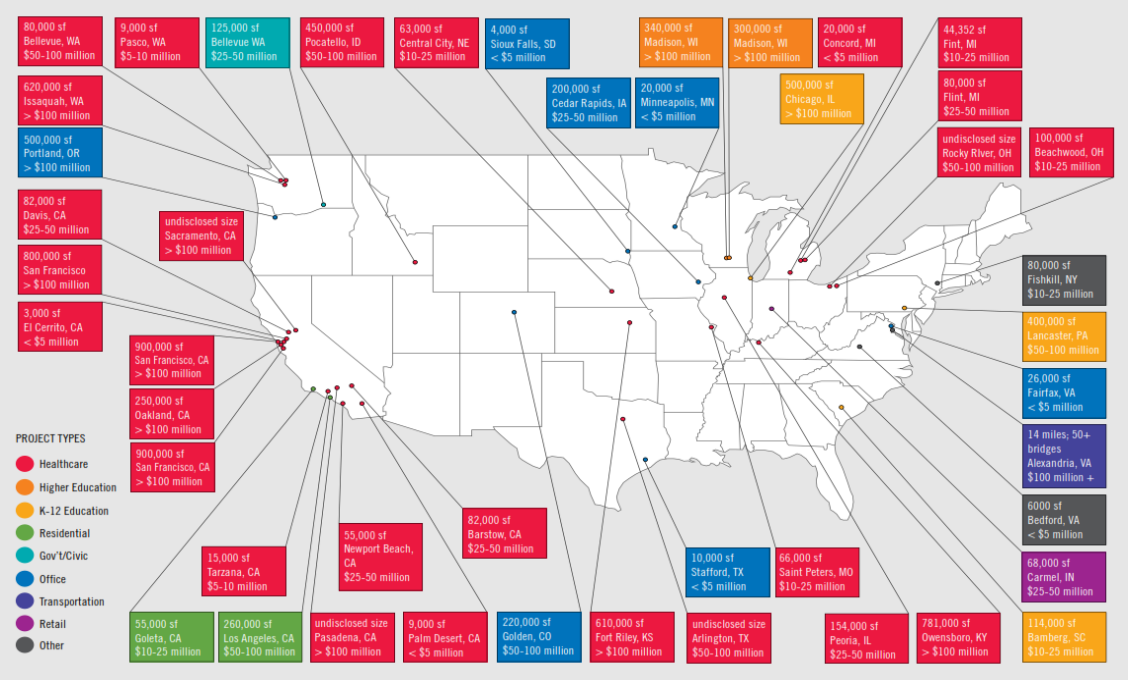

Figure 2.4: IPD map in USA (Cheng, 2012)

Figure 2.4 gives more details on every project undertaken in the USA by giving its type, size, scope and location. Sutter's Fairfield Medical Office Building which begun in 2005, is considered to be one of the first "*real*" and pure IPD projects in America (California) and around the world. Lessons learned from this pilot project have been applied to larger and more complex projects (Cheng, 2012).

2.7 Need for Change

2.7.1 Current Structure of the Construction Industry

Navigant Consulting Inc. (2017) is a specialized, global professional services firm, defines the traditional construction industry contractual arrangement as being the design-build (DB) model and its variant. The Construction Management Association of America (CMAA) in its (2012) report gave the overview of delivery methods in today's word construction marketplace, the frequency of each of the delivery methods is approximately as follow Figure 2.5:

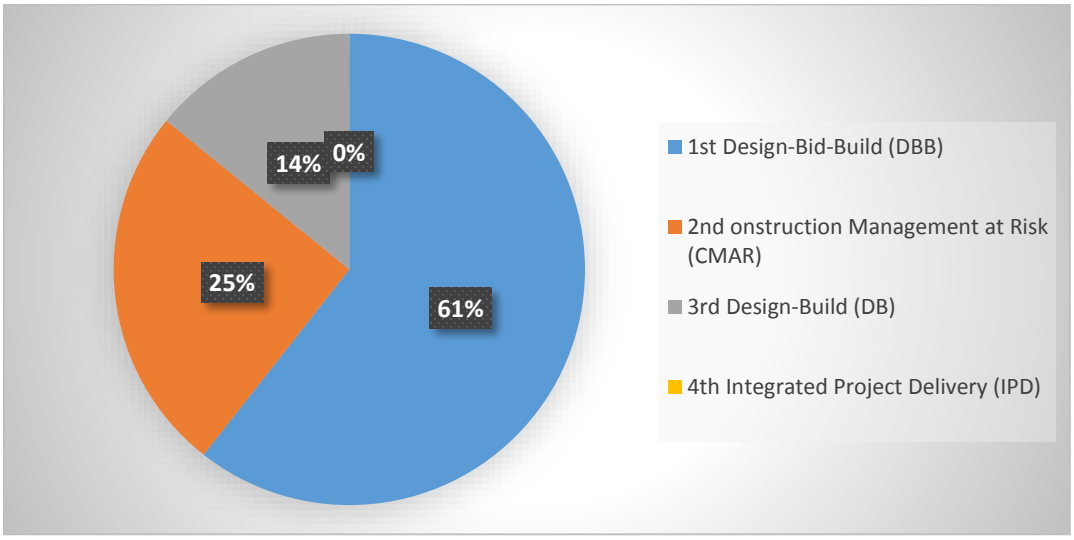

Figure 2.5: Current distribution of delivery method in the construction market (CMAA, 2012)

With the following breakdown:

- ✓ Design-Bid-Build (DBB) 60%
- ✓ Construction Management at Risk (CMAR) 25%
- ✓ Design-Build (DB) 14%
- ✓ Integrated Project Delivery (IPD) <1%

As shown in the above breakdown, the traditional contractual arrangement is actually leading the construction industry. However, the validation of IPD as a distinct delivery method still needs an overall industry unanimity.

The traditional delivery method is structured on the basis that, the design professionals enter into a separate contract with the owner, who in turn separately contracts the general contractor, who, in turn, contracts separately with the various trade contractors, suppliers and vendors. At the beginning of the project, the contractor is forced, to document designs which took years to be completed and to discover error and omission in a very short time, sometimes during the implementation of the project. Knowing that, the contractor bid and manage the project aggressively. The designer attempt to defensively over-design and transfer design risk to the contractor through specifications, requiring extensive verification, coordination, and contract interpretation clauses. Finger pointing behavior,

claims, disputes and litigation characterize this kind of projects and according to Ashcraft (2010) none of this is in the owner's best interest.

2.7.2 Stakeholders Relationship

Each type of delivery method results in different events and requires different types of relationship between parties involved in the contract. Effective relationship management can mean the difference between a problematic contract and a smoothly run one. A study on management practices and procurement methods in 15 major European infrastructure projects showed that the "*hard*" aspects of project management such as risk analysis, and cost control, were generally better managed than external and internal relationships (Hertogh, et al., 2008). The strong fragmentation of the construction industry and the conflicting relationship favored by the traditional delivery method between key stakeholders is blocking the successful completion of projects. Relationship management remains one of the key issues to be solved in order to successfully complete project.

Table 2.3 illustrates the differences between traditional delivery method and IPD approach with regard to team approach, process, risks, compensation, communication, and agreement etc. in order to understand the relationship structure of both and more important to compare them.

Table 2.3: Traditional framework verses IPD philosophy (McGraw, 2008)

Integrated Project Delivery		***Traditional Project Delivery***
Learning, continual improvement, engaging with reality	***Culture***	Blame, finger pointing, exploiting loopholes, individual reward maximization, risk averse
Systems thinking; Optimize the whole; encourage, foster & support multi-lateral open sharing & collaboration	***Thinking***	Command & control; encourage unilateral effort; Break project into constituent parts; Optimize parts(especially “my bit”)

Integrated Project Delivery		***Traditional Project Delivery***
Outside-in: act on the system to improve it *for customers* (helped by those working in it).	***Management Ethos***	Top-down: Manage the contract,manage the program, manage budgets, manage people
Integrated with work; based on data	***Decisions***	Separated from work
Related to purpose, capability & variation	***Measures***	Budget output, activity, standards, productivity
Based on demand, value & flow; open, collaborative & integrated team of key players formed at the outset & added to as the stakeholder group grows	***Organization Design***	Functional specialization; fragmented silo based, strongly hierarchical, controlled; constructors not generally added until late in process
Concurrent & multi-level; high trust & respect	***Process***	Linear, distinct, siloed (over-the-wall);
Shared openly & early	***Knowledge & Expertise***	Gathered "just-as-needed", hoarded in silos
Collectively managed, appropriately shared	***Risk***	Individually managed, transferred as much as possible
Team success tied to project success; value-based	***& Reward Compensation***	Individually pursued; min effort for max return; (usually) first-cost based
Digitally based, virtual; Building Information Modelling (3, 4 & 5D); Short-term planning e.g. Last Planner	***Communication Technology***	Paper-based, 2 dimensional; analog;
What *matters* to them? – Understanding Their *human* & technical conerns.	***Attitude to Customers***	Contractual

Team approach, process, risks, compensation, communication, agreement etc. constitute a set of elements that establish the basis upon which key stakeholders relationship rely on. They have to be clearly defined and understood by project team members.

2.7.3 Decrease of Productivity

Construction projects using the traditional delivery method are characterized by owner's dissatisfaction, unchanged results, time and cost overruns, poor quality, lengthy and costly litigation, and disruption of relations between the contracting parties. The first IPD project was motivated by the realization that escalating costs, missed completion dates, and projects wrought with claims was not the best way to meet owner‘s needs (Keith, 2010). Construction owners are evasive, while contracting parties interpret contract terms differently and, for their own benefit.

Productivity levels is decreasing compared to other industries and have even declined over time all over the word (O'Connor, 2009). In the same vein, the United State Department of Commerce, Bureau of Labor Statistics, reports that among all major industries, construction is the only one to have actually experienced a decline in productivity since 1964 (McGraw, 2008) Figure 2.6.

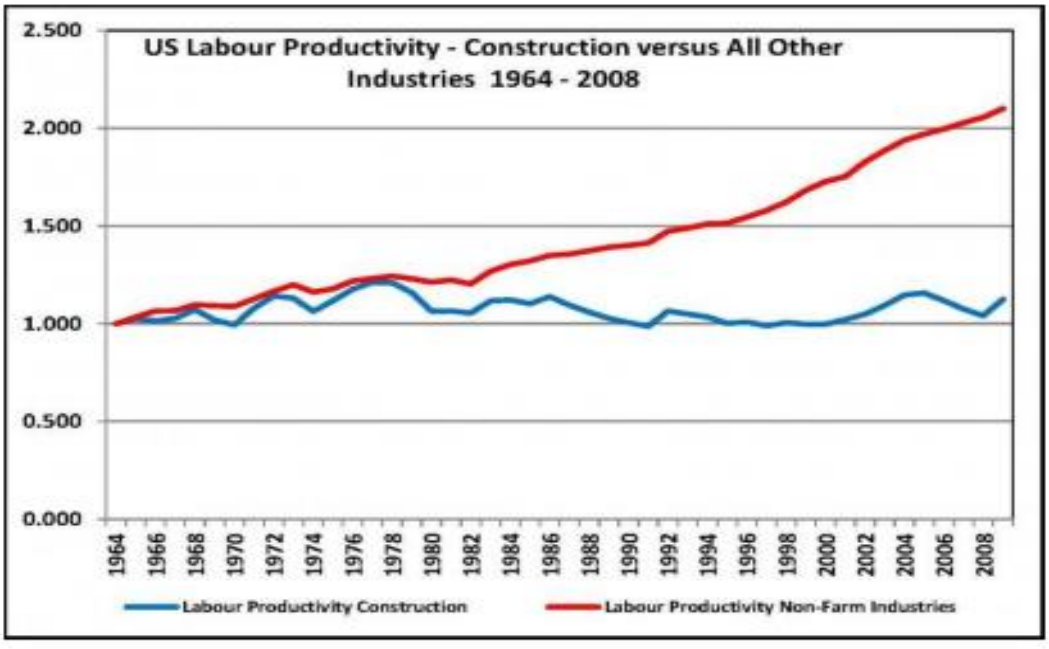

Figure 2.6: Labor productivity in construction and non-farm industries (McGraw, 2008)

As shown in Figure 2.6 the same report concludes by showing that while the average productivity has more than doubled since 1964, it has actually decreased in the construction sector. According to O'Connor (2009), a number of workplace forces contribute to waste and low productivity in the construction industry, such as poor contracting practices, unequal risk allocation and inappropriate delivery approaches. Even projects that are perceived as successful often have many similar problems. Knight (2008) reveals some of them in his report, where he stated that these disastrous project involves several change orders, hundreds of interpretation requests of contract documents, conflicts during construction, and overtime. Add to these, additional financial claims due to errors, omissions, unforeseen and unexpected conditions, delays caused by poor and untimely communication during the design or construction phases (Knight, 2008). The conclusion of this study reveals the big problem that has led to lack of productivity and waste.

To deal with the problem described above and deliver efficient projects, Wilson (2014) illustrates how IPD generally devotes more time and energy to make decisions at the beginning of the project, when the ability to impact the project positively is higher. This approach can enhance the outcomes of projects, because IPD include making changes on the road, when the impact on cost, quality and time are negligible. Thus in the traditional method they make changes during the implementation process when the pressure becomes high and the changes costly Figure 2.7.

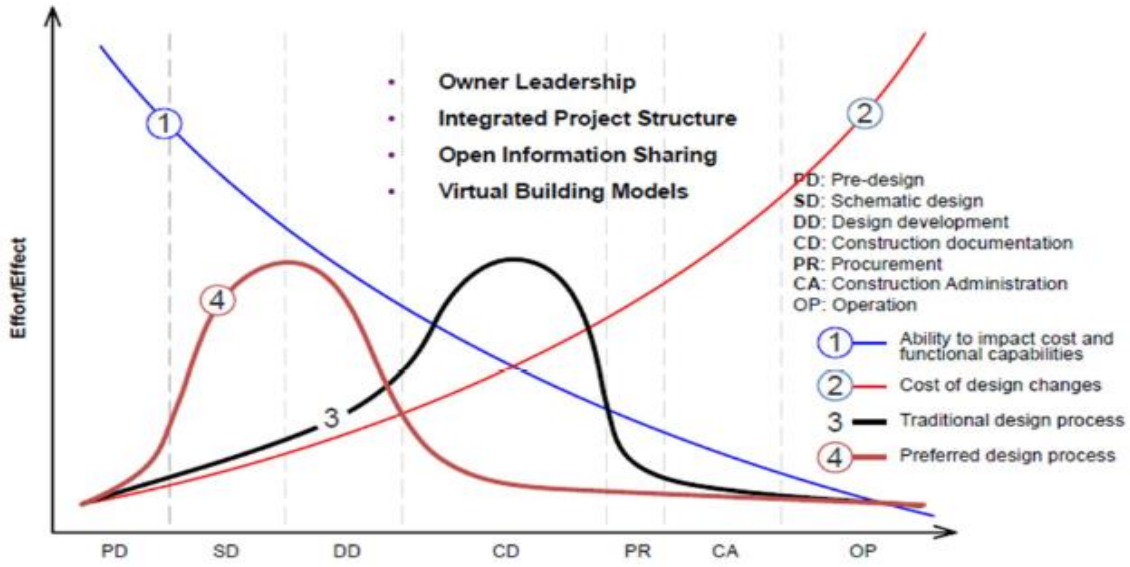

Figure 2.7: Impact of changes as project progresses (Wilson, 2014)

As shown in the above Figure 2.7 the major part of the work is done at the beginning of the project when using the IPD, and when using the traditional delivery method the effort is concentrated during the construction documentation process.

Figure 2.8 compares the time the definition of project features and participants (what, who, how) occur when using the two structure.

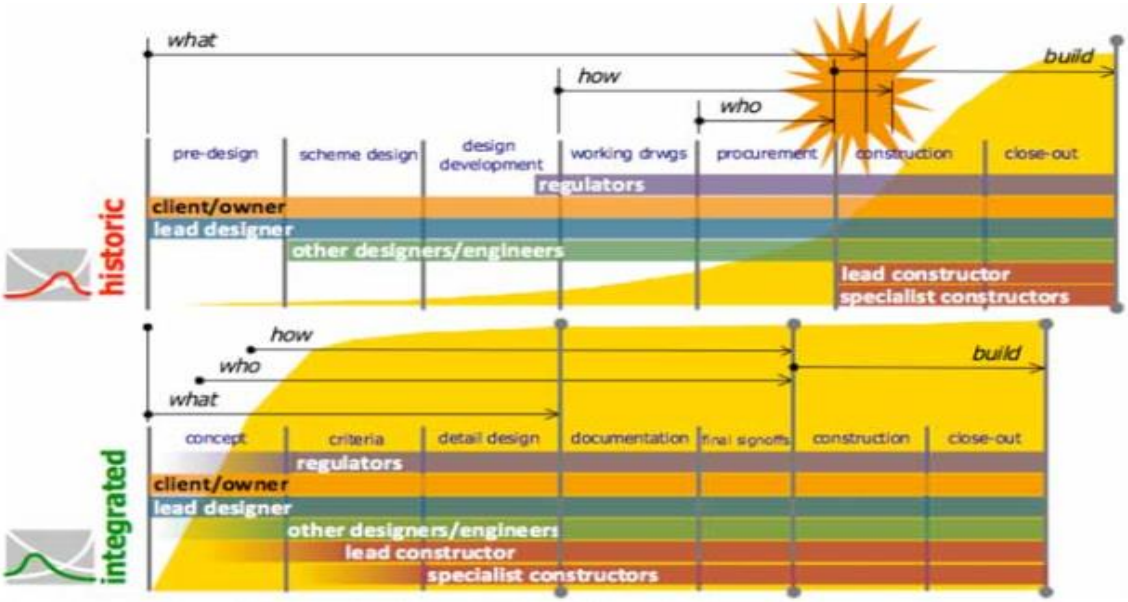

Figure 2.8: Comparison of historic and integrated project delivery timelines (Eckblad, et al., 2007)

As shown in Figure 2.8 the IPD timeline is shorter than the traditional delivery method. It also shows how IPD helps define very early in the process key stakeholders, project goals and the project constructability.

2.7.4 Risk Allocation

In a typical construction project using the traditional delivery method, each stakeholder intends to rely on declared or hidden contingencies to cover predictable and unpredictable risks. According to Knight (2008), one of the least well-kept secret of the construction industry is that, the provision of design and construction services is egocentric and inefficient. Risk assessment and risk allocation are considered a dark art in the construction industry. Some researchers define risk allocation in the construction industry (especially using the traditional delivery method) as an exercise of economic Darwinism (Long & P.E., 2017).

In the AIA (2010) report on IPD, the study stated concerning risk allocation that, often when using the traditional delivery method, architects attempt to shift as much risk as possible to contractors, contractors to architects and owners to both of them. Traditional design and construction contracts seek to manage risks by narrowly defining roles and responsibilities. Each participant must then be vigilant in order to limit the scope of their activities to prescribed parameters, which reinforces the isolation of the behavior in silo, limiting collaboration and alignment with the project goals.

IPD propose a different philosophy concerning risks allocation. Risks are collectively managed by key stakeholders and shared in an appropriate manner as shown above in *table 2.3.* By using IPD structure for collaboration, risks allocation can shift from being often characterized by divergent interests compounded by uncertainty to focus on the success of the project. IPD risks allocation is designed to encourage behaviors that lead to exceptional project performance and value (Ashcraft, 2010).

2.7.5 Wastage

The construction industry contributes significantly to a country's economy, but is also one of the most inefficient and unprofitable sectors compared to other related sectors. A study conducted by the School of Building Construction at the University of Florida in the United States and published by the Building and Construction Technology department of the University of Pretoria in South Africa gives the following results regarding waste in the industry of construction. Worldwide, the construction and operation of the built environment has been estimated to account for (Macozoma, 2001):

- 12-16% of fresh water consumption;
- 25% of wood harvested;
- 30-40% of energy consumption;
- 40% of virgin materials extracted;
- 20-30% of greenhouse emissions;
- 40% of the total waste stream of countries;
- 15-30% of which ends up in landfill sites;
- Up to 15% of purchased materials at jobsite ending up as waste.

Waste management in construction sites can be achieved through waste prevention during the design and procurement phases. Macozoma (2001) proposed the same analysis, thinking that, designers can play an important role in green building, especially in waste management. It can be done by designing buildings for waste reduction through doing more with less and by designing buildings which allows building component and material recycling at the building's end of life. However, this can only work if the contractor and his team first understand the designs and second, have the training and commitment to do so.

The approach proposed Macozoma (2001) is encouraged by IPD, where communication between stakeholders is effective at the design stage. With IPD, additional waste are eliminated through better information exchange, streamlined decision-making processes and a reduction in selfish behavior, thus leading to better results.

2.8 Construction Industry Challenges in Developing Countries

According to Ofori (2010) major problems faced by the construction industry in developing countries are:

- Globalization;
- Culture; and
- Environment.

2.8.1 Globalization

Studying the implications of globalization in the construction industry of developing countries is very important. As far as this industry is concerned, globalization is an inescapable fact not only for the construction industry, but for all related industries. Indeed, many construction projects that developing countries need for their socio-economic development exceed the capacity of their industries, because of the size, novelty and complexity of these projects (Drewer, 1980). For this reason, construction industries in developing countries are forced to import construction activities in order to deliver quality

project. In Zambia more than 80 percent of construction projects are executed by foreign firms (Simumba, 2018).

In fact, Raftery et al. (1998) and others have advised developing countries to use foreign construction companies to support the growth and development of their local entrepreneurs, thus they can replace foreign firms in the future. They also suggest that, in the long term, the gap between local construction companies and their counterparts in technology, finance and management could be filled by technology transfer, using means such as joint ventures between groups of firms. To illustrate the above argument, Ofori (2000) notes that China and India have several adequate local contractors but foreign firms are still active on their sophisticated-construction market.

IPD is considered to be the solution for the future construction industry, IPD structure should be considered and introduced as soon as possible to construction practitioners in developing countries. This should be done in order to respond to globalization and to be at the same level with technologically advanced countries construction practices as changes are occurring in the industry around the world.

2.8.2 Culture

The framework of the construction industry, structure, forms of contact, practices and principles used in developing countries have been inherited from developed countries. What is noteworthy is the fact that, ironically, the countries of origin of these contractual arrangement are changing their approach from the traditional framework to new delivery methods, while in developing countries they have limited effort leading to review the traditional delivery structure despite its lame outcomes. According to Ofori (2010) these existing ones (traditional delivery methods) are not only currently obsolete, but they are also inappropriate, in this era. The conclusion of Ofori seems to be a wakeup call to quickly introduce a new approach such as IPD in the construction industry of developing countries.

2.8.3 Environment

Since 38 percent of carbon emissions come from the construction industry (Prince, 2014), all countries concerned by environmental issues and must participate in the effort to reduce

carbon emission. "*However, the issue of environmental preservation should even be for greater interest to developing countries as they face serious environmental problems and do not have the same means as industrialized countries to face these challenges. Most of these countries have fragile environments and face high levels of land degradation (erosion, aridity, desertification, drought, flooding, alkalization and salinization)*" (UNCHS, 1996). To achieve this goal of reducing carbon emissions from the construction sector some concept like green building, which require an integrated and collaborative form of contract exist to provide efficient buildings and energy efficient. With the IPD, the goal of environmental efficiency can be achieved (Jackson, 2010).

2.9 Synthesis of Literature Gap

The aforementioned reviewed literature both from the global and African perspectives had a lot to offer to the current study in that it has clearly shown what other researchers' have covered so far and area that need a special attention to make IPD an operational tool for the construction industry. However from this literature development, the apprehension is that limited progress has been done showing clearly the principles and practices which are supposed to be used when implementing the IPD as a delivery method. Goldberg (2015) recognized that even the IPD guide did not provide the necessary tools to implement IPD. There is a lack of IPD research considering the capacity of contractors, designers and owners to implement IPD with regards to challenges that they may face in their particular environment. There is also a lack of research explaining clearly the adequate procurement structure when IPD is used as a delivery method.

IPD is based on a collaboration structure which highly depend on how much parties are trustworthy. Trust being a difficult element to measure, a detailed set of principles have to be clearly outlined and followed in order to achieve outcomes that IPD claims to offer to the construction industry. The combinations of contractual principles, behavioral principles and IPD catalysts can lead sometimes to confusion in the way that every researcher gives his own opinion based on a personal experience or observation on principles that are imperative for IPD. The confusion comes also from the number of IPD principles which keep on increasing and the fusion of certain contractual and behavioral principles. Consequently, for the purpose of this study, nine principles were identified (Six contractual

and three catalysts) that can be considered imperative for the success of an IPD project in the Zambian context.

2.9 Summary

This chapter reviewed the literature on IPD which is an emerging delivery method in the construction industry. It places particular emphasis on the research done by specialized professional institutions on IPD in order to define and describe in detail the structure of this new delivery method. It also had a look on individual research to obtain the opinions and comments of construction practitioners who have experienced the IPD in its pure form, claims that motivate the call for change in the construction industry as well as the challenges faced by the construction industry in developing countries. At the end of each phase, comments on the benefit of introducing IPD structure was mentioned. The following chapter discusses the methodology and tools used to ascertain that data are collected in an accurate method and analyzed in an adequate approach.

CHAPTER THREE: METHODOLOGY

3.1 Introduction

The previous chapter discussed the literature review by giving a detailed description of IPD, reasons traditional delivery method is falling to give desired outcomes and how IPD structure can be considered as a solution for future by delivering efficient construction projects. This chapter presents the methodology used to gather and analyze data in a systematic manner in order to answer research questions while pursuing the objective of this study.

3.2 Research Type

The objective of a research philosophy is to lead the researcher towards a choice of a specific, well organized and verified content for its legitimacy (Flyvbjerg, 2006). Kothari (2004) described many types of research such as descriptive; analytical; applied; fundamental; quantitative; qualitative; conceptual; empirical and others. He also add that these types of research fall under two fundamental research approach which are quantitative, qualitative.

3.3 Research Approach

This study used the qualitative and quantitative approach through a multiple case study analysis and a survey questionnaire as instruments, which are in-depth methods according to Morris (1991) when undertaking a study in management field with an aim of performance improvement. It is grounded on qualitative material to produce outcomes either in non-quantitative method or in the methods which are not exposed to laborious quantitative examination (Kothari, 2004). Other researcher like Singleton (2010), University of Minnesota (2012), and Hassan (2013) used this method in their studies on IPD.

3.4 Research Design

A traditional research design is a detailed plan of how a research needs to be completed by integrating different components of the study in a coherent and logical way (Thyer, 1993). The design includes the diagram or the complete program to be followed in order to gather and analyze data in a systematic manner.

Figure 3.1 gives an overview of different stages of methodological approach considered for this study with respect to the logical sequence.

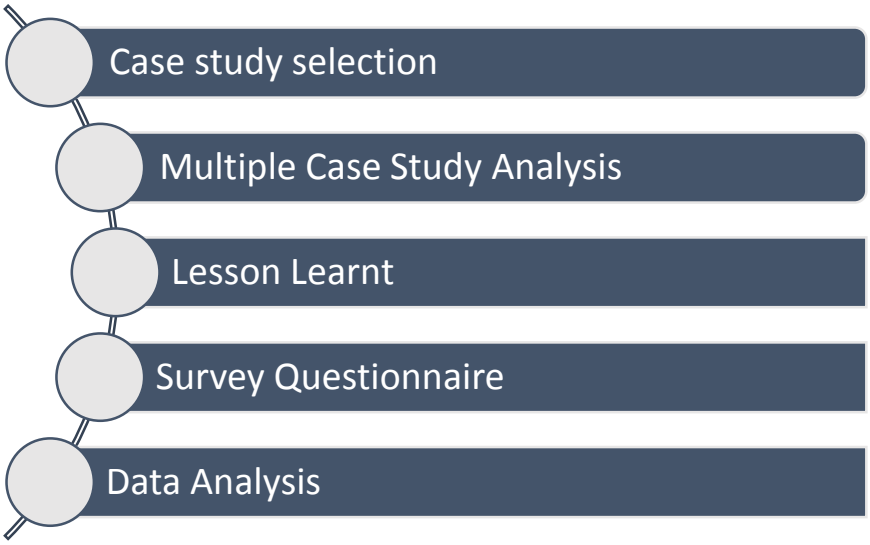

Figure 3.1: Research process

The purpose of the process presented in Figure 3.1 is to make sure that the proposed route gives us valid, relevant and reliable data.

3.5 Research Instruments

Two research instruments were used to achieve the objectives of this study:

- Multiple case study analysis and
- Survey questionnaire

3.5.1 Multiple Case Study

Robson (1993) defines a case study as "*a strategy for doing research which involves an empirical investigation of a particular contemporary phenomena within its real life context using multiples sources of evidence.*" Another, parallel, definition is that, a case study is an analysis of systems that are studied with a comprehensive view by either one or several methods (Thomas, 2011). Creswell (2013) said the case study process "*explores a real-life, contemporary bounded system (a case) or multiple bounded systems (cases) over time, through detailed, in depth data collection involving multiple sources of information and reports a case description and case themes*". As mentioned by these researchers the credibility of case studies rely on the diversity of sources of information.

Other scholars used this same method to investigate IPD. Cohen (2010) analysed six IPD case studies which appeared in the American Institute of Architect (AIA) guide for IPD projects, in the same vein Singleton (2010) analyzed four IPD case studies to come up with his conclusions on the implemetation of IPD in the department of the Navy construction projects.

a. Rational for Choosing Multiple Case Study

The case study method is a very popular form of qualitative analysis and involves a careful and complete observation of a phenomenon, a social unit, be that unit a person, a family, an institution, a cultural group or the entire community (Kothari, 2004). The multiple case study, is for real life events, showing abundant sources of evidence by imitation rather than by sampling logic. Case study is one of the method used to undertake organizational and management studies and to conduct dissertations in social sciences. Yin (2009) mentions in his report that this method is more appreciated in the academic disciplines as well as professional fields such as business administration, management science, and social work. Construction management falling in the management field, this approach appears to be more suitable to undertake this research.

For the benefit that it proposes, the multiple case study is an appropriate choice for this study. *"Benefits with a multiple case study analysis are the fact that the researcher is able*

to analyze the data within each situation and across different situations. The researcher studies multiple cases to understand the similarities and differences between the cases and therefore can provide the literature with important influences from its differences and similarities" (Gustafsson, 2017). Case study research is one of the most powerful research methods in management science, particularly in the development of new theory (Morris, 1991). It is argued to be a favorable strategy for attaining a broad understanding of the research context, and the procedures being announced. In addition, the multiple sources of confirmation are emphasized and are viewed as critical in terms of securing data (Robson, 2002). Other benefits are that *"the evidence generated from a multiple case studies are strong and reliable. The researcher can clarify if the findings from the results are valuable or not. It also allows a wider discovery of theoretical evolution and research questions. When the suggestions are more intensely grounded in different empirical evidence, this type of case study then create a more convincing theory*" (Gustafsson, 2017).

b. Advantages

The use of a multiple case study method, can lead to the following outcomes (Kothari, 2004):

- Make a complete study, through which we try to understand the complexity of factors that are operative within a phenomena;
- The case study method helps to know the mutual inter-relationship of causal factors.
- Under case study method the behavior pattern of the concerning phenomena is studied directly and not by an indirect and abstract approach.
- Case study enables the generalized knowledge to get richer and richer. In its absence, generalization in management science, and social science may get handicapped.
- Case studies establish the unspoiled type of management material as they denote a factual record of personal experiences which very often escape the care of most of the skilled scholars using other methods.

c. Disadvantages

However, case study also presents also a certain number of limitations:

- It is difficult to generalize on the basis of an individual case; therefore, the case study cannot contribute to scientific development (Starman, 2013).
- The case data are often vitiated because the subject may write what he thinks the investigator wants; and the greater the rapport, more subjective the whole process is (Kothari, 2004).
- Case studies contain a bias toward verification; that is, a tendency to confirm the researcher's preconceived notions (Flyvbjerg, 2006). The researcher in case could be tempted by the falsification of results in order to confirm this hypothesis.

3.5.2 Questionnaires

As Lee (2006) mentioned in his report, questionnaires are beneficial for assessing state of mind, concepts, and penchants about theories as well as attitudes towards the applicability of a new knowledge, skills, and approaches required in a given area. Primary data for this study were obtained through direct communication with consultants, contractors and regulators in form of questionnaires assessing the applicability of IPD principles for ZCI. The questionnaire were addressed to consultants because they are one of the key participants in a construction project. They are the one carrying the major responsibility to manage construction projects and because of their proximity with owners who makes the decision on the delivery method to be used. Contactors were also concerned because they are the one having the responsibility of carrying out the work and the first to be affected by poor management. And finally regulators because they have the ability to drive changes in the ZCI.

According to Kothari (2004) there are several method of primary data collection in survey and descriptive research which include questionnaire. Questionnaires can collect data by (1) asking people questions or (2) asking them to agree or disagree with statements representing different points of view (Babbie, 2001). This study used the second type of questionnaires which is described by Stehr-Green, et al., (2003) as a closed-ended questionnaire, it is used when imaginable answers are known and the range of responses is

constricted enough to be provided in short list to respondents. This questionnaire involves a number of questions typed and printed in fixed instruction on a form. The questionnaire were given to respondents who read, comprehend, and put in writing in the space provided their answers. The respondents were supposed to answer themselves the questionnaires without any other intervention.

a. Advantages

Kothari (2004) and Lee (2006) outline a certain number of merits associated with this data collection method:

- There is low cost even when the universe is large and is widely spread geographically;
- More likely to get answers;
- It is free from the bias; answers are collected in an organized manner;
- Easier and quicker to answer;
- Respondents have adequate time to give well-thought-out answers;
- Easier to code and statistically analyze;
- Respondents, who are not easily approachable, can also be reached conveniently;
- Easier to compare different respondents' answers;

b. Disadvantages

The same researchers also mention in their studies a certain number of demerits which have to be considered when using questionnaires as instrument for data collection.

- Low rate of return of the duly filled in questionnaires; bias due to no-response is often
- Creativity, self-expression, and richness of detail are hindered;
- It can be used only when respondents are educated and cooperating;
- The control over questionnaire may be lost once it is sent;
- There is inbuilt inflexibility because of the difficulty of amending the approach once questionnaires have been dispatched;
- Unanticipated findings cannot be discovered;

3.6 Pilot

Pilot questionnaire was targeted at consultants, contractors and regulators operating in ZCI. The reasons owners, notwithstanding their position in the decision making on a construction project were not targeted, it is because they are difficult to identify and have no thorough understanding of the technical part of questions asked. All necessary remarks were well thought-out in order to get a perfect final questionnaire.

3.7 Item Scaling

The commonly used scale rating in developing questionnaires are (Lee, 2006):

- ✓ Thurstone scaling,
- ✓ Likert scaling, and
- ✓ The semantic differential scaling.

This study used the likert scaling system which is widely used and very common in questionnaires because of its easier structure, high dependability, and successful variation to measure many types of affective features (Edwards & and Kenney, 1946) (Kothari, 2004). The anchor points considered were:

(1) Strongly Agree;
(2) Agree;
(3) Ensure;
(4) Disagree;
(5) Strongly Disagree.

3.8 Target Population

Target population refers to all the members who meet the particular criterion specified for a research investigation (Alvi, 2016). Kothari (2004) defines the population as the whole set of people or object devising some mutual characteristics as defined by the sampling criteria established for the study. Clear definition of the study population and the sampling process is very important, if not well done, it can disturb the legitimacy of the study. If the study population suffers from sampling fault, the study population will not appropriately represent the research sample. The survey targeted Zambian construction practitioners

(consultants, contractors and regulators), based on their familiarity with construction contracts.

3.9 Sampling Techniques

Kothari (2004) claim for a use of purposive sampling when the universe happens to be small and a known characteristic of it is to be studied intensively. The main objective of purposive sampling is to concentrate on precise characteristics of respondents that are of interest, which will best permit to answer research questions (Lead dissertation ltd, 2012). It was described by Stake (1995) as a group of various sampling techniques that rely on the judgment of the researcher when it comes to selecting the units (e.g., people, cases/organizations, events, etc.) that are to be studied. This study used purposive expert sampling because of the need of opinions and appraisal of respondents with a high degree of understanding about the study area. This sampling method offer the advantage of allowing researchers and readers to better understand the intricacies of the sample and it is claimed to be cheap, easy and fast (Lead dissertation ltd, 2012). It has a goal of getting a representative sample of the population being studied. The behavior of the selected small group is analyzed and the accurate results are or can be applied to a larger group for generalization.

3.10 Sample Size

A representative sample size should not be less than 5% of the population under consideration (Judd, et al., 1991). This opinion is confirmed by other statistical experts who suggested a data range between 5 to 10 times the number of item used in the scale (Hair Jr., 2010). The number of population being unknown, smith (2010) formula was used, to ensure the correctness of the sample size considering the fact that the size of the population was unknown. According to Smith (2010):

Necessary Sample Size = (Z-score) ^{2} * (StdDev) ^{2} / (margin of error) ^{2}

Equation where:

Z-score: Correspond to the confidence level

The most common confidence intervals are 90%= 1.645 confident, 95%= 1.96 confident, and 99%= 2.326 confident.

StdDev: Standard deviation

Smith (2010) advice to take 0.5 as the safest decision, because it is the most tolerant number and ensures that the sample is sufficient.

Margin of error: we used of +/- 10%

With 90% confidence level, 0.5 standard deviation, and a margin of error of +/- 10%.

Necessary Sample Size $= ((1.645)^2 \times 0.5(0.5)) / (0.1)^2$

$= (2.706 \times 0.25) / 0.01$

$= 0.6765 / 0.01$

$= 67.65$

= 68 respondents were needed

Following from this, 73 adequate respondents for data collection were identified. A total of 73 questionnaires were distributed. 48(66%) of questionnaires were received for a total number of 73(100%) questionnaires distributed and the remaining 25(34%) were not received. The questionnaire is attached as appendix 1.

Demographic characteristics

The demographic characteristics of responses received in relation to the academic qualification are described in Table 3.1 and Figure 3.2 which shows that half of the respondents were bachelor's degree holder and the remaining 50% had a postgraduate degree.

Table 3.1: Level of academic qualification

Highest level of academic qualification	**frequency**
bachelor's degree	24
master's degree	17
doctorate	7
Total	48

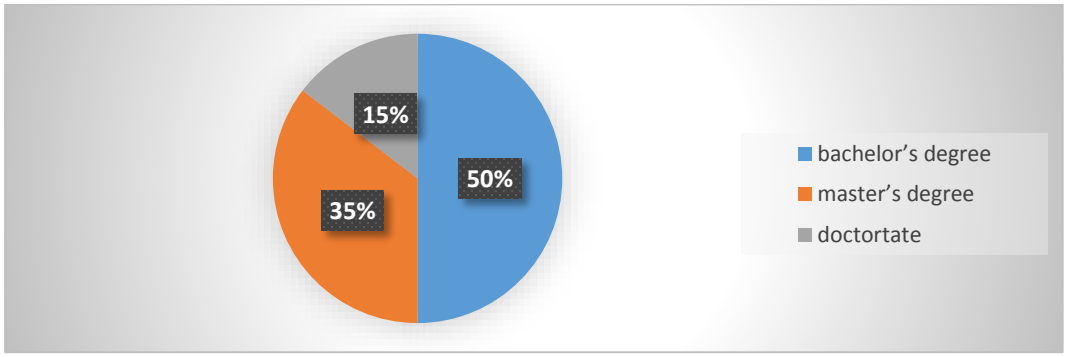

Figure 3.2: Academic qualification of respondents

Table 3.2 and Figure 3.3, gives the distribution of response in relation to the category of company of the respondents. The large majority of respondents were from consulting firms. This may be explained by the responsibility consultants have, of coordinating, supervising and directing operations within a construction project in harmony with the contract, task that requires a familiarity with construction contracts. In the category others are comprise local authorities and regulators in public institutions in the construction sector.

Table 3.2: Category of company

Position	**frequency**
Contractor	9
Consultant	33
Others	6
Total	48

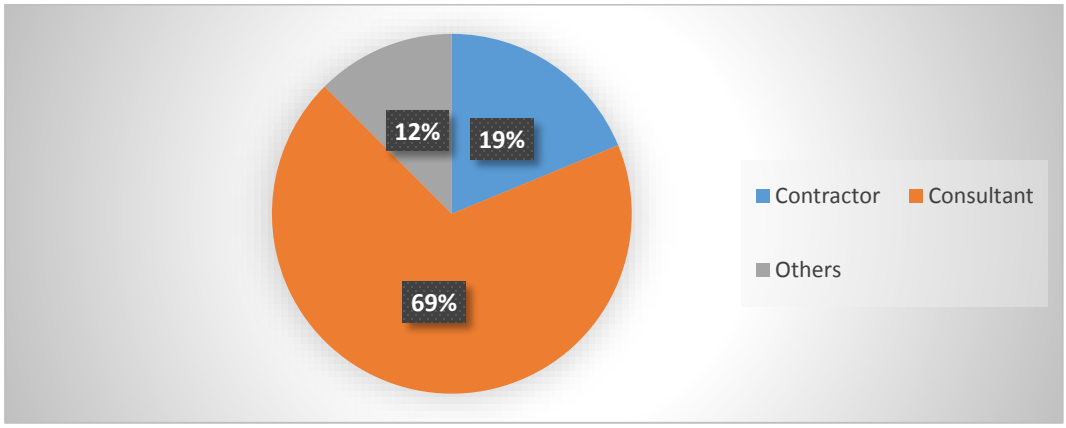

Figure 3.3: Category of Company

3.11 Data Collection Procedure

3.11.1 Primary Data

For the primary data, questionnaire were distributed to construction practitioners with a clear description of the aim of the research. After that, the collected filled and valid questionnaires were considered for analysis using SPSS.

3.11.2 Secondary Data

Data were selected, in order to fill the theorical categories and to give real life examples of the implementation of IPD and the way it impact projects outcomes. The considered literature and case studies were not randomly selected but reflect the selection of specific situation in order to extend the IPD theory to a broad range of organization. Several elements within the literature and each case study, explain and give its participation to the theory developed.

3.12 Data Analysis

Data analysis is the heart of the research and the most important process when introducing a new concept. For the multiple case study, data were analyzed and treated in the objective of building a hypothesis from the within sites analysis which include analysis of relationship between different variables. The analysis was based on multiple source of evidence to build theories which defines this phenomena and distinguished them from other traditional and well known theories for construction project delivery. The description, and measurement were frequently explained from the study development itself, rather than being specified unilaterally. The lessons came out from a depth judgment of the strength and consistency of relationships within and across the case studies considered and a depth understanding of the procedure and their impact on the outcomes, in order to publish a full theory that can be comprehended and applicable to the Zambian environment. Quantitative data from survey results were analyzed by the use of a software namely statistical packages for social science (SPSS) for frequency analysis. Qualitative data collected was analyzed in the structure shown in Figure 3.4:

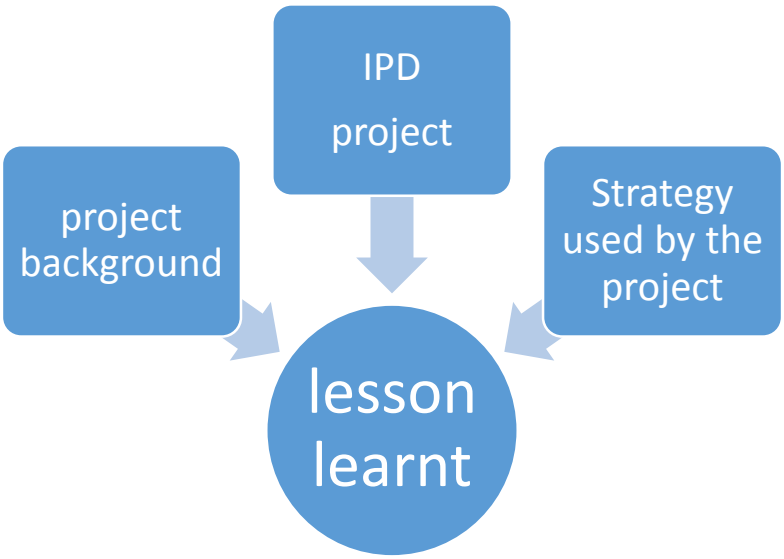

Figure 3.4: Data analysis structure

The elements in Figure 3.4 are describe as fallow:

- IPD Project

  The selected projects are those that have used the IPD in its pure form as a delivery method.
- Project background

  A short story describing the circumstances or situation prevailing at the project under consideration.
- Strategy used by the project

  A detailed IPD principles, practices and techniques used in the chosen project.
- Lesson learnt

  The lessons learnt from the chosen project and selected principles, practices and techniques that seems to be applicable for ZCI.

3.13 Reliability and Validity of Data

Different opinions among methodologists arise about the notion of validity and reliability of data. According to Yazan (2015) this process is supposed to push the researcher to seek the most credible interpretation or knowledge about the case. This process should seek to answer the following questions: "*Are we generating a comprehensive and accurate description of the case? And are we developing the interpretations we want? Rather than focusing on having it right*" (Stake, 1995). When assessing the validity and reliability of

data collected, a certain number of sources of evidence are supposed to be considered in order to produce data which are reliable, verifiable and most important useful for the body of knowledge. However a comprehensive source of confirmation being extensive, this study used only sources of evidence which appeared important to justify findings. Three of the six sources of evidence described by Yin (2009) were considered in this study for a multiple case study analysis, which are documentation, archival records, and physical artifacts. Face and content validity was used for the survey questionnaire as advice by Marshall & Rossman (1989).

3.15 Ethical Consideration

This research was approved by the University of Zambian through the school of engineering under the department of civil and environmental engineering. Written informed consent to participate voluntarily was acquired from all respondents. Participants were similarly informed that they had the right to withdraw at any time from the data gathering process. They were also informed on the main purpose of this study. All sources of information have been duly acknowledge.

3.12 Location of the Study

The study concerned with construction practitioners working in ZCI especially those located in Lusaka. It is important to understand that construction firms are not tight to a city location. Construction firms are mostly endowed with capacity to execute project country wide. A construction firm wherever its city location it is part of ZCI and can reflect the image of the all industry country wide.

3.16 Summary

This chapter reviewed the methodology used for this study. The research philosophy, research approach, research design and the appropriate instruments used to gather data were thoroughly discussed. A data analysis structure was drawn to show the process followed to achieve the final objective pursued by this study. The chapter also clarified the means used to assure the reliability and validity of data collected. The following chapter

present the findings from the multiple case study analysis and outline the lessons learnt from them.

CHAPTER FOUR: CASE STUDIES

4.1 Introduction

The previous chapter discussed the methodology used in this study by describing the design, the research instruments and the data collection method. This chapter presents case studies using a systematic approach which describes the background, the strategy undertaken and lesson learnt from the considered cases analyzed. This process was done in connection with research questions in order to come up with the best possible strategy to achieve the desired outcome for this study.

4.2 Case Study Selection

The selected case studies present real world completed building projects which have used Integrated Project Delivery (IPD) as a delivery method in its pure form. The selection process was based essentially on three main criteria, which are:

4.2.1 Completed Project

It was important to focus on the completed project, because this made it possible to compare project desired outcomes verses achieved goals. With this criteria it was easy to measure the three elements of a successful construction project, which are quality, time and cost.

4.2.2 Availability of Data

Reviewed literature shows that there are more than 59 construction projects which had or are currently using IPD as a delivery method. In many of these projects there is currently no relevant survey to produce data related to the concerned projects. Using a purposive sampling, four case studies were selected which had relevant data from various source of evidence.

4.2.3 IPD Delivery Method

Confirming that the selected project used the IPD in its pure form was imperative because the argument of success or failure of the nominated project was based mostly on the delivery method used rather than on others elements.

4.3 Case Selected

The case studies selected are the following:

i. Autodesk Inc.;
ii. Sutter Health Fairfield Medical Office Building;
iii. Encircle Health Ambulatory Care Center;
iv. Walter Cronkite School of Journalism;

Detailed project data on each case study is presented in Appendix 2.

4.4 Fundamental Principles

For the purpose of this study the analyzed case studies focused on the fundamental principles of IPD. Cook (2007) divide these principles in three categories, which are contractual, behavioral and IPD catalysts (Cook, 2007):

4.4.1 Contractual Principles

These are written into agreements:

1. Key Participants Bound Together as Equals;
2. Shared Financial Risk and Reward Based on Project Outcome;
3. Liability Waivers between Key Participants;
4. Fiscal Transparency between Key Participants;
5. Early Involvement of Key Participants;
6. Intensified Design;
7. Jointly Developed Project Target Criteria; and
8. Collaborative Decision-Making.

4.4.2 Behavioral Principles

These are necessary for project optimization but are ultimately choice-based:

9. Mutual Respect and Trust;
10. Willingness to Collaborate; and
11. Open Communication.

4.4.3 Catalysts for IPD

These can be greatly beneficial for optimizing project results:

12. Multi-Party Agreement;
13. Building Information Modeling;
14. Lean Design and Construction; and
15. Co-location of Team.

Among the described fundamental principles, only the contractual requirement and IPD catalyst were analyzed in the selected case studies as shown in Table 4.1.These principles also appear in various professional institutions documents on IPD (AIA, 2007) (AGCA, et al., 2010) (Lean Construction Industry, 2016). Behavioral principles were left out because of their qualitative nature and the lack of appropriate tools to measure them.

Table 4.1: Fundamental principles of IPD selected for this study

Contractual principles	**Catalysts for IPD**
1. Shared risk and reward 2. Liability waivers 3. Fiscal transparency 4. Early Involvement of key participants 5. Jointly developed project goals 6. Collaborative decision-making	7. Multi-party agreement 8. Building information modeling (BIM) 9. Co-location of team

4.5 Case Studies

4.5.1 Background

a. Autodesk Inc.

Autodesk Inc., a company that creates design software for the AEC (architecture, engineering, construction, and other industries), wanted to highlight ways in which its own technology could support Integrated Project Delivery (IPD), Building Information Modeling (BIM), design-to-fabrication, sustainability, and building performance analysis. The company decided to put those goals forward with its own project (Cohen, 2010). In spring of 2008, Autodesk sought an architect/builder team to complete a 5,110 m², three-story interior tenant improvement that uses all of the space in a new speculative office building in Waltham, Massachusetts along Boston's Route 128 technology corridor (University of Minnesota, 2012). The selected stakeholder's team members had no experience in IPD, this experience was new for everybody.

b. Sutter Health Fairfield Medical Office Building

Sutter Health project is said to be the first "true" IPD project in the world. In spring of 2005, Sutter Health, one of the largest not-for-profit health care providers in Northern California, was seeking an architect and contractor to design and build a 6,504 m² medical office building in Fairfield, California (University of Minnesota, 2012). The project included a medical office building housing primary care medical practices and laboratories, with pediatrics, oncology, rheumatology, and cardiology departments and administrative offices (Cohen, 2010). This assignment was the first built component of a $6.5 billion, as such it gave Sutter the occasion to test out an innovative procedure of collaboratively designing and building facilities in a relatively small project.

c. Encircle Health Ambulatory Care Center

In 2006, Encircle Health selected architect, HGA, and contractor, Boldt, to design and build a $38.6 million ambulatory care center in Appleton, Wisconsin. The owner decided before selecting the design and construction team to follow an integrated form of agreement based on the Sutter Health contract model. ThedaCare, HGA and Boldt all had worked together previously on other projects, this was one of the major factor when selecting the team for this new project (University of Minnesota, 2012). The Encircle Health project is a three-story, 14,493 m² ambulatory care center combining physician practices with ancillary diagnostic services (Cohen, 2010).

d. Walter Cronkite School of Journalism;

In 2006, Arizona State University (ASU) in partnership with the City of Phoenix had 24 months to complete the Walter Cronkite School of Journalism on a downtown site in Phoenix, Arizona. The Cronkite School was expected to set a high standard of design quality given its significance to developing ASU downtown campus and prominence within the city. Finding an alternative project delivery method was essential to achieving the design goals within the schedule and budget constraints; because there was no time for a design-bid-build scenario (University of Minnesota, 2012). The Cronkite School is a build-to-suit venture by the City of Phoenix for Arizona State University (ASU) and financed by a city bond measure (Cohen, 2010). The six-storey, 21,367 m² project consists of academic classrooms and offices for the School of Journalism and Mass Communication, University-operated public television, general purpose ASU classrooms and ground floor retail intended to activate the street (Cohen, 2010).

Table 4.2 describes features of projects under consideration. The purpose of this comparison is to show the implementation of IPD in a variety of construction projects, of different types, scales, team members, budget and in diverse regions.

Table 4.2: Project description

Project description	Autodesk Inc.	Sutter Health Fairfield Medical Office Building	Encircle Health Ambulatory Care Center	Walter Cronkite School of Journalism
Location	Massachusetts. USA	California. USA	Wisconsin. USA	Arizona. USA
Type	Office building	Healthcare	Healthcare	Higher Education
Owner	Autodesk Inc.	Sutter Regional medical Foundation	Encircle Health, ThedaCare and independent Physician groups	City of phoenix
Architect	KlingStubbins	HGA Architects and Engineers	HGA Architects and Engineers	Ehrich Architects, HDR
Contractor	Tocci Building Companies	The Boldt Company	The Boldt Company	Sundt Constrution
Project start	May, 2008	July, 2005	2006	2006
Project completed	January, 2009	November, 2007	2009	2008

The selected case study documents a wide range of team experience, from teams with quite a bit of experience to those who were implementing IPD for the first time. For those without experience such as Autodesk Inc.; Sutter Health Fairfield Medical Office Building and Walter Cronkite School of Journalism, stakeholders took the risk to use their project as a learning experience. Among the four projects, only Encircle Health Ambulatory Care

Center project had the architect and contractor with a bit of experience from a similar IPD project where they both participated.

4.5.2 Strategy Used

a. Multi-Party Contract

Table 4.3 shows contract summary of each case study.

Table 4.3: Contract form summary for each case study

Contract	Autodesk Inc.	Sutter Health Fairfield Medical Office Building	Encircle Health Ambulatory Care Center	Walter Cronkite School of Journalism
Contract	Multi-party contract	Sutter Health. integrated form of agreement (IFOA)	IFOA	Design/build
Number of signing parties	Four	Eleven	Three	Two
Participants	Owner, general contractor, and two architects	Owner, the architect, the General Contractor, key design consultants, key sub-contracts, and Lean/BIM consultant	Owner, architect, and contractor	Owner/designer-contractor
Subcontractor	Mechanical/fire protection, electrical, and drywall	N/A	Mechanical, electrical, plumbing/fire protection and exterior glazing	N/A

As a lesson learnt, the IPD multi-party contract has to be used as a standard form which should be associated with particular conditions of contract containing amendments from the signing parties. These changes must be reviewed and adapted to meet their particular needs, specific requirements of the project, and applicable laws. This implies the fact that the review must be done by people having specialized knowledge of contract language and practice. For the Encircle Health Ambulatory Care Center project the contract was signed after thorough review by construction attorneys of the signing parties. The IFOA is used nowadays as a multi-party standard contract form for IPD health care projects. It was originally a modified multi-party contract to match Sutter Health Fairfield Medical Office Building project needs.

"*Things that were written in the contract, such as bid review deadlines and so on, had we followed that we would never have been successful*" (Cheng, 2012). This is the contractor's project manager commenting on Walter Cronkite School of Journalism project where an IPD contract was not signed but parties committed to use IPD practice in the implementation process. Getting into an IPD scenario without a signed contract can be considered as dangerous practice. As Prince (2014) reported, far from being considered as a trap, this signed document protects different parties participating in the contract, because the behavior can easily change when the participants start experiencing loss (Prince, 2014). This is the reason why Walter Cronkite School of Journalism project was considered level two collaboration and the remaining level three in the IPD checklist Table 4.11. The Walter Cronkite School of Journalism project can also be considered as a proof that IPD practices can be adopted on a philosophical basis by participants and still give positive results.

b. Shared Risk And Reward

Table 4.4 indicates the summary of risk allocation for each project.

Table 4.4: Risk allocation summary

Autodesk Inc.	Sutter Health Fairfield Medical Office Building	Encircle Health Ambulatory Care Center	Walter Cronkite School of Journalism
Shared pain and gain	Shared pain and gain	Shared pain and gain	N/A
Incentive Compensation Layer created	They completely separated the cost of the work from the profit (profit in a separate bucket from fee)	They completely separated the cost of the work from the profit (profit in a separate bucket from fee)	Money saved through efficiencies was put back into the project for value-add items.
Anticipated profit were put at risk	Incentive payment was an acknowledgement of a job well done, not the driver of it.	Profits are protected even when work (done at cost) is increased or decreased	
If specific goals are met, designers and contractors receive their normal profit, jointly	Contingency funds jointly managed rather than at the owner's discretion alone	No one is hurt if work is shifted from one party to another for overall project benefit	
If they are exceeded, the firms were eligible for additional compensation		The more saved, the higher the percentage of compensation to the non-owner participants	

The lesson learnt is that, the model used by Sutter Health Fairfield Medical Office Building project and Encircle Health Ambulatory Care Center; seems to be the better one. The IFOA provided to focus on reducing the overall project risk rather than shifting it between parties. Concerning shared pain and rewards, the main lesson learnt from this process is that the best way to guarantee profitable arrangement is to fully isolate the cost of the work from the profit, by putting profit in a separate bucket from fees. The benefits of this system, is the assurance of getting:

1. Participants to act in a project centered behavior;
2. Willingness to communicate on every issue,
3. Protection of profits do not drive behavior (no scarcity).

The philosophy used for Autodesk Inc. project where profits are put at risk by the use of a financial incentive for participants, can instinctively lead to the mindset of business as usual with "If and then" scenario. This structure can cause unwelcome changes in behavior when profits are not protected. Risk and pain sharing requires also a clear definition of the allocation of contingency in case desired outcomes were to be exceeded and if money is left over, there is no dispute about what can be added to the project and what can go into the incentive pool.

c. Liability Waivers Among Key Participants

Table 4.5 summarized liability waivers from each project.

Table 4.5: Liability waivers summary

Liability Waivers	Autodesk Inc.	Sutter Health Fairfield Medical Office Building	Encircle Health Ambulatory Care Center	Walter Cronkite School of Journalism
waivers	all claims against each other	consequential damages was limited to the amount of its fee	limitation on total liability and consequential damages	N/A
"No sue" clause	Yes, except for fraud, willful misconduct or gross negligence	no	no	no
Alternative dispute resolution	yes	yes	yes	yes
Order of precedency	Mediation; arbitration	Core team; expert third party; mediation	Core team; expert third party; mediation	N/A

It appear that the existence of a "No sue" clause in the multi-party contract is one of the conditions of contract that is difficult to be adopted by contracting parties. Except for the special case of Autodesk Inc. project where a "No sue" clause was adopted minus certain conditions, the project participants to the other projects did not agreed to include a "No sue" in their contract. Signing parties of IFOA in the Sutter Health Fairfield Medical Office Building project and Encircle Health Ambulatory Care Center project, considered that the presence of such clause, could lead to some non-controllable behavior among the team members.

However, every time a "No sue" clause did not appear in the agreement, project participants sign an agreement to give priority to alternative dispute resolution options before engaging courts to solve issues. The proposed structure helped reduce the pressure on project participants during the implementation process. The other imperative element learnt is the importance of giving a comprehensive list of order of precedency of dispute resolution approaches, the concerned parties, their roles and responsibility when a problem arises. Parties tend to rely on the ability of this structure to solve contractual disputes, if roles and responsibility are not clearly defined, the system can crush and lead to a traditional scenario.

d. Early Involvement of Key Participants

Table 4.6 lists key stakeholders that were involved early in each project.

Table 4.6: Early involvement of parties

Early Participants	Autodesk Inc.	Sutter Health Fairfield Medical Office	Encircle Health Ambulatory Care Center	Walter Cronkite School of Journalism
Main Participants	Owner, general contractor, and two architects	Owner, the architect, the General Contractor	Owner, architect, and contractor	Owner/designer-builder
Subcontractors involved early	Mechanical/fire protection, electrical, and drywall	Mechanical Engineer; Structural Engineer; Electrical Engineer; Mechanical Trade Partner; Plumbing Trade Partner; Electrical Trade Partner; Fire Protection Trade Partner and Lean Project Integrator & BIM Technology Manager	Mechanical, electrical, plumbing/fire protection and exterior glazing	Engineers and Critical trades

As lesson learnt, early involvement of major stakeholders is fundamental and imperative to the success of an IPD project. For the Autodesk Inc. project the main participants and subcontractors worked from the beginning on the scoping taken to the level of conceptual design, in which everyone worked at cost until a deep understanding of the project and a level of comfort around the program and budget was achieved by all parties (Cheng, 2012). The IPD early involvement structure changes from the conventional linear design arrangement where specialized designers begin work earlier, maintain a whole-systems view and see the interrelationships of building systems which were not yet been fully designed. Most of the time this process is done without connection to the scope, cost and budget. However when major stakeholders are involved in the scoping, scheduling and costing exercise, it increases the design quality, constructability, reduced construction delays, and the contractor and subcontractors better understand design intent (Bendewald & Franta, 2010).

Another lesson learnt from the Sutter Health Fairfield Medical Office Building project and Encircle Health Ambulatory Care Center project is that early involvement of key stakeholders when the multi-party contract concern many parties, led to the creation of an integrated project team (IPT) to help parties get scoping, scheduling and costing agreement and identify clashes in the system. The project manager of the architectural firm emphasized that, they drew 30% fewer details, because the subcontractor was involved from the get-go and their input was incorporated in the design drawings (University of Minnesota, 2012).

The Walter Cronkite School of Journalism project shows that when the designer and contractor are selected as one team, design consultants and critical subcontractors can be brought on board immediately and participate in the design process.

e. Jointly Developed Project Goals

Table 4.7: Describes joint developed project goals for each case study.

Table 4.7: Project goals summary

Joint Goals	Autodesk Inc.	Sutter Health Fairfield Medical Office	Encircle Health Ambulatory Care Center	Walter Cronkite School of Journalism
Main Participants	Owner; general contractor; and two architects	IPT	Owner; architect; and contractor	Owner/designer-builder
Defined goals	Schedule; budget; and Leadership in Energy and Environmental Design (LEED) Platinum,	Schedule and budget	Budget; schedule; and LEED Silver or higher	Budget; schedule and LEED
Assessment	Three comparable projects; Independent evaluator; and LEED	Benchmarking of comparable medical office buildings; and Conditions of Satisfaction	LEED	LEED

The lesson learnt from these, the analyzed case studies show that jointly defining project goals is fundamental for the success of the project, rather than bringing into the project parties that have no idea of projects goals, as it's done in the traditional method. More important is to spell out specific criteria that would be used to judge success at the pre-design stage. This structure when completed during the design stage can help the integrated team keep track of the impact on cost for every decision affecting the design, the quality and the schedule. This is what was done for Sutter Health Fairfield Medical Office Building project and Encircle Health Ambulatory Care Center project. As a benefit, these two project did not need the end to know if their decision was sustainable and efficient with regard to the predefined goals, they were aware in the process.

The second lesson learnt is that in order to attain sustainable goals, the Walter Cronkite School of Journalism project hired a LEED consultant to supervise the design process and help the project to achieve the defined project sustainability goals. Since 38 percent of carbon emissions come from the construction industry (Prince, 2014), it will be beneficial to associate environmentalists in the pre-design and the construction.

f. Collaborative Decision-Making

Table 4.8 summarized the decision making structure for each case study.

Table 4.8: Decision making summary

Hierarchy	Autodesk Inc.	Sutter Health Fairfield Medical Office	Encircle Health Ambulatory Care Center	Walter Cronkite School of Journalism
Champion	Owner	Owner	Owner	All primary project (participants Owner/designer-contractor)
Team structure	A Project Implementation Team (PIT); Project Management Team (PMT); and Senior Management Team (SMT)	An Integrated Project Team (IPT); Higher Level Core Team(HLCT); and Executive Level Committee(ELC)	Board of Directors; Core Team(owner, architect and contractor); Specialized Component Teams	Executive Committee

The lesson from this process is that, IPD collaboration decision making structure provide to create a decision making team with the input of major project participants instead of abandoning the engineering firms to their own judgment when an issue arises. In the IPD structure the owner must be kept engaged from earliest design and throughout construction. In the Sutter Health Fairfield Medical Office Building project the owner had his own project manager who understood the work and participated in the decision making process.

In the Autodesk Inc. project; the contract provided three levels of decision making process, treating problems according to their order of importance and their impact on the project outcome. This process was effective because it provided time, firstly to analyze issues by the team that best understand its origin and secondly this process avoided overwhelming the team which does not have enough knowledge on the problem raised. This structure helped gain time in the implementation process by avoiding the notification process. It can be of great benefit on tight schedule, because it requires that decision be made and not revised.

Different structures were agreed for the three other projects, however all of them had an objective to consider the input of major stakeholders before taking any decision. Requiring a Joint and careful participation to the decision making process, leverages pools of expertise and enhance the possibility of getting quick answers to a problem that arises.

g. Building Information Modeling (BIM)

Table 4.9 indicates BIM agreement for each project.

Table 4.9: BIM summary

Software	Autodesk Inc.	Sutter Health Fairfield Medical Office Building	Encircle Health Ambulatory Care Center	Walter Cronkite School of Journalism
Architect	BIM	BIM	BIM and Navisworks	BIM
Contractor	BIM	BIM	BIM and Navisworks	BIM
Subcontractors	BIM	BIM	Others	BIM

The lesson learnt were that, IPD multi contract as a provision requiring all major stakeholders to use BIM. The purpose of this provision is to solve the problem of interoperability of software which is very critical issue to deal with when project participants are using different design software's. This provision is more about the use of a common software rather than on the use of BIM.

When teams are using same technological tools and materials, it has a benefit of providing continuous and immediate availability of reliable, integrated and coordinated design, scope, schedule and cost information. This provision allow the elimination of rework for coordination which implies transferring the models back and forth from one software to another. It can turned out to be cumbersome and delay the project.

Another lesson learnt is, this provision requires the integrated team, to establish the BIM parameters, standards and technological requirements. For this provision to work faultlessly, team members must be assured that their particular team members are adequately trained to the use of the required software.

h. Co-Location of Team

Table 4.10: Summarized the use of big room concept for each project.

Table 4.10: Co-location summary

Co-location	Autodesk Inc.	Sutter Health Fairfield Medical Office Building	Encircle Health Ambulatory Care Center	Walter Cronkite School of Journalism
Philosophy	*"Big Room"*	*"Big Room"*	*"Big Room"*	*"Big Room"*
Co-located parties	Owner; general contractor; two architects and major subcontractors .	Eleven signing parties.	Owner; architect; contractor and critical subcontractors.	Owner/designer-builder; engineers and critical trades
Frequency	Part-time	Weekly	frequently	Part-time

As lesson learnt, co-location of team members makes the team optimize their effectiveness by using IPD principles. The face to face exchange between key project participants helped to build trust between members and focus the relationship on the success of the project. The principal in charge of the architectural firm for the Walter Cronkite School of Journalism project said, "*co-location works because when you work that closely together you naturally develop a relationship of trust. When everyone is in their own office, using email and staying at arms' length it doesn't allow that to happen"* (University of Minnesota, 2012). The meetings are based on a contractual requirement, teams meet on a defined frequency to work on the project, not just occasionally when a problem arises.

In the Sutter Health Fairfield Medical Office Building project, the big room concept acted like the center of intelligence for the project. All technical issues were solved by this strategy using the configuration described by Bendewald & Franta (2010) in their report:

i. Large configurable meeting space to allow more than 30 peoples to work comfortably;
ii. Space for planning the process (big wall) with enough room for more than 30 people to stand and work);
iii. Space for planning the design (wall sized marker board) that can be used for both planning and sketching design ideas;
iv. Smart board (s), two or more to project the 3D model, plans, schedule, and be able to share them remotely with other team members;
v. Planning tables so small teams can focus on refining their plans;
vi. Small team meeting rooms.

The second lesson learnt is that the Big room concept is more about technical capability of team members. It can be difficult to handle and easily turn into a training center when the team members do not have the same understanding of technical isssues, and finally delay the implementation process. The project manager of the architectural firm on the Walter Cronkite School of Journalism project insisted on the quality, skills and experience of professionals sitting in the big room by saying:*" the big room concept would have not solve any problem, If we did not have the right people"* (Cheng, 2012).

i. Fiscal Transparency (Open Books)

Table 4.5 shows the usage of all contract related documents for each project.

Table 4.10: Open book summary

Documents	Autodesk Inc.	Sutter Health Fairfield Medical Office Building	Encircle Health Ambulatory Care Center	Walter Cronkite School of Journalism
All books in regard to the project	Open	Open	Open	Open
Project finances	Transparent	Transparent	Transparent	Transparent

One lesson learnt is that, Construction administration is considered as nerve center of operation in the management of construction projects. IPD structure requires project stakeholders to commit to a transparent decision-making, proactive and non-adversarial interaction, problem-solving, sharing of ideas, continuously seek to improve project planning, design, construction processes, to share both the risks and rewards associated with achieving the project objectives and most important project finance by opening all books related to the project. These documents are not just opened but accessible at any time by all project stakeholders.

In the Sutter Health Fairfield Medical Office Building project, the contractor website became the storehouse of project information and the place where submittals were made and managed electronically by every project participants (University of Minnesota, 2012). The same strategy was used in the Encircle Health Ambulatory Care Center project, here it was the team that decided to create a website for information exchange which was accessible by all project participants at any time.

4.5.3 IPD Checklist

Table 4.11 provides the checklist of the analyzed principles for each project and the corresponding level of collaboration.

Table 4.11: IPD checklist for the project analyzed and level of collaboration

IPD CHECKLIST				
IPD characteristics	Autodesk Inc.	Sutter Health Fairfield Medical Office	Encircle Health Ambulatory Care Center	Walter Cronkite School of Journalism
Multi-party agreement	yes	yes	yes	no
Shared risk and reward	yes	yes	yes	no
Liability waivers	yes	no	no	no
Early Involvement of key participants	yes	yes	yes	yes
Jointly developed project goals	yes	yes	yes	yes
Collaborative decision-making	yes	yes	yes	yes
Building information modeling	yes	yes	yes	yes
Co-location of team	yes	yes	yes	yes
Fiscal transparency	yes	yes	yes	yes
Level of collaboration	**3**	**3**	**3**	**2**

NAFSA, et al.(2010), describe IPD level of collaboration in the following way:

- ✓ Collaboration level 1, Typical and not contractually required.
- ✓ Collaboration level 2, Enhanced with some contractual requirements.
- ✓ Collaboration level 3, Required; collaboration required by a multi-party contract

As shown in Table 4.11, only Walter Cronkite School of Journalism had level 2 collaboration because the IPD agreement was not signed despite the use of IPD principles in the implementation process.

4.5 Summary

This chapter presented case studies using a systematic approach which described the projects background, the strategy undertaken and lesson learnt from each. This process was done considering 9 key points contained in the IPD checklist for each case study. It is from the lesson learnt and the philosophy of the IPD contractual agreement that the questionnaire

contained in the survey were built. The following chapter presents and discusses the results of the survey.

CHAPTER FIVE: RESULTS AND DISCUSSION

5.1 Introduction

The previous chapter analyzed case studies that have used Integrated Project Delivery (IPD) in its pure form. This chapter present findings of the survey by showing the perception of Zambian construction practitioners to the approach that IPD proposes. It also discusses these results by connecting and challenging them to some of the arguments contained in the literature review and the case studies in order to prove the evidence of these findings and their relevance in the body of knowledge. The chapter focuses essentially on findings related to the last research question which concern the applicability of IPD in Zambia.

5.2 Response Rate

Result analyzed by Statistical Packages for Social Science (SPSS) 20, give the following distribution: 48(66%) of questionnaires, that were received for a total number of 73(100%) questionnaires distributed and the remaining 25(34%) were not received as shown in Figure 5.1.

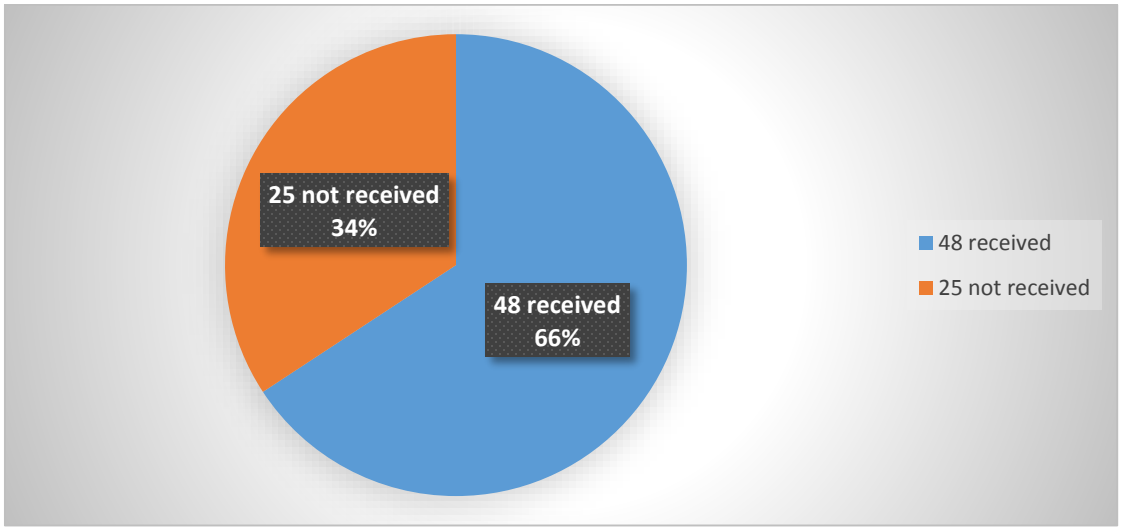

Figure 5.1: Response rate of questionnaire survey

5.3 IPD Approaches

5.3.1 Contractual Principles

The first category assessed was the IPD contractual principles. 87.4% of respondents agreed with statements coming from the IPD main contract. The remaining 12.6% either disagreed or were unsure. Table 5.1 and Figure 5.2 give more details.

Table 5.1: Contractual Principles Frequencies

Keys	Responses	
	frequency	Percent
strongly agree	280	36.5%
agree	391	50.9%
unsure	45	5.9%
disagree	16	2.1%
strongly disagree	36	4.7%
Total	768	100.0%

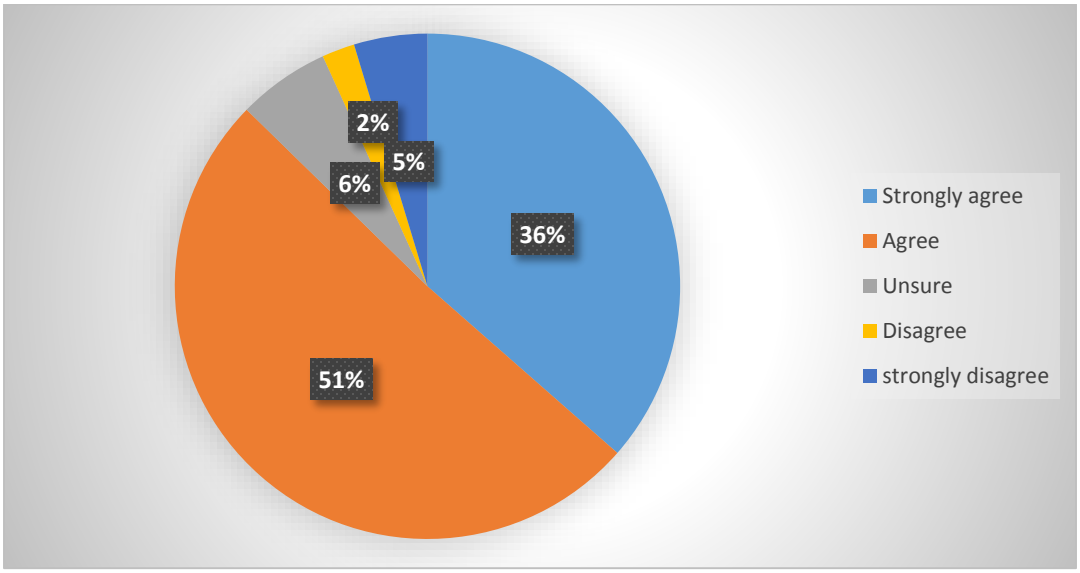

Figure 5.2: Contractual principles

The respondents perceived IPD contractual principles as being fundamental measures to enhance the quality of construction projects delivered. The vast majority of respondents agreed on the statements concerning:

1. Key participants bound together as equals,
2. Shared financial risk and reward based on project outcome,
3. Fiscal transparency between key participants,
4. Early involvement of key participants,
5. Intensified design,
6. Jointly developed project target criteria, and
7. Collaborative decision-making

This proved the understanding of the importance of collaboration and joint decision making process to deliver quality construction projects.

Contractual principles that lead to confusion concern, liability waivers between key participants which include the presence of a "no sue" clause in the contract and the use of only alternative dispute resolutions to solve problem between contracting parties. A “no sue” clause is always perceived as an act of irresponsibility because, as Prince(2014) argued in his presentation on the integrated principles of construction management, change of behavior become inevitable when parties start experiencing loss of money. Prince's argument shows that contracting parties are tempted to act more irresponsably when there is no risk of litigation. The perception of Zambian construction practitioner’s on the presence of a "no sue" clause in a contract corroborate with the general observation of other researchers like (University of Minnesota, 2012), (AIA, 2010), (Cheng, 2012), (Cohen, 2010), (Chaney, 2014), (Burcin, et al., 2010) who realized in their research that nobody accepted to include a "no sue" clause in the IPD contract. On the other hand these researchers noted that instead of having a "no sue" clause, parties agreed to prioritize on a contractual basis alternative dispute resolution approaches before engaging the court. This is in contradiction with our results which shows a refusal to have an agreed process to follow before engaging the courts.

5.3.2 IPD Catalysts

For IPD catalysts the analysis of results show that 69.8% were in agreement and the remaining 29.2% of respondents were unsure on the usefulness of the suggested tools to deliver project more effectively. Table 5.2 and Figure 5.3 give more details.

Table 5.2: Catalysts for IPD Frequencies

Keys	Responses	
	frequency	Percent
strongly agree	53	27.6%
agree	81	42.2%
unsure	56	29.2%
disagree	2	1.0%
strongly disagree	0	0.0%
Total	192	100.0%

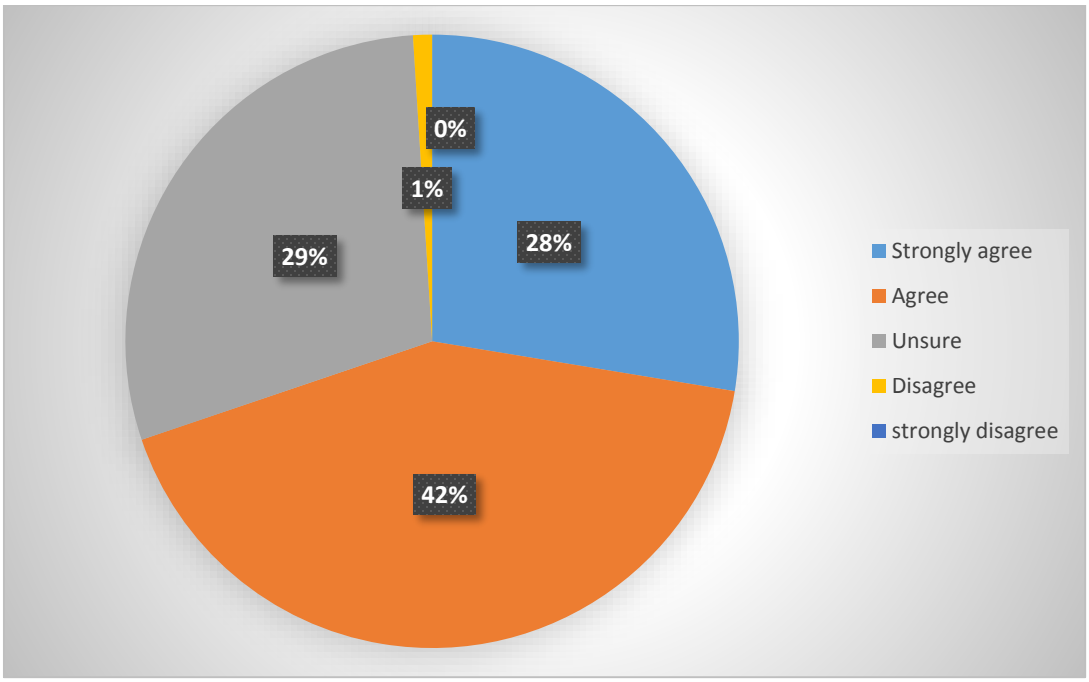

Figure 5.3: Catalysts for IPD

Catalysts for IPD concern the use of tools and practice that can be greatly beneficial for optimizing project results. Apart from some fundamental principles such us co-location of team, IPD catalyst are essentially based on technological element such as the use of BIM.

Respondents perceived IPD catalysts as being crucial measures to improve the quality of construction projects delivered. The vast majority of respondents approved the statements concerning:

1. Multi-party agreement; and
2. Co-location of team.

This corroborates with the AIA (2010) and Cheng (2012) where the response were significantly positive concerning securing a big room and merge different key participants to work together and keep track of the project features. The negative and neutral responses on catalysts for IPD concerned fundamentally the use of BIM. This can be explained by the lack of familiarity with BIM in ZCI. BIM mixes all the trades and design aspects in 3D and aids simplify the scope of work, sequence the work from the beginning to the end and the constructability of all the components of the project. Training of Zambian construction practitioners on BIM and its benefits will help get enough expertise with such a technological tool, in order to coordinate the work, could lead to a different perception on this question. Looking at the results of the analyzed case studies compare to the results of the survey, it can be concluded that there is a tendency to minize the importance of interoperability when it comes to technological tools. The analysed cases studies show that lack of software interoperability can greatly influence the schedule in a negative way and can help identify system clashes during design and provide significant cost saving.

5.3.3 Adoption of IPD in ZCI

Finally, the research assessed the general point of view of respondents on the usefulness of all the principles, practices and techniques suggested by the IPD in the survey. The questions related to the ability of IPD principles to help deliver project more efficiently in ZCI if they were to be observed by construction practitioners. As shown in Table 5.3 and Figure 5.4, 97.9% of respondents perceived that the adoption and application of IPD principles in ZCI would help deliver project within the expected time, with respect to the cost and with the required quality.

Table 5.3: Ability of IPD to deliver project efficiently in ZCI Frequencies

Keys	Responses	
	Number	Percent
strongly agree	64	66.7%
agree	30	31.2%
unsure	2	2.1%
disagree	0	0%
strongly disagree	0	0%
Total	96	100.0%

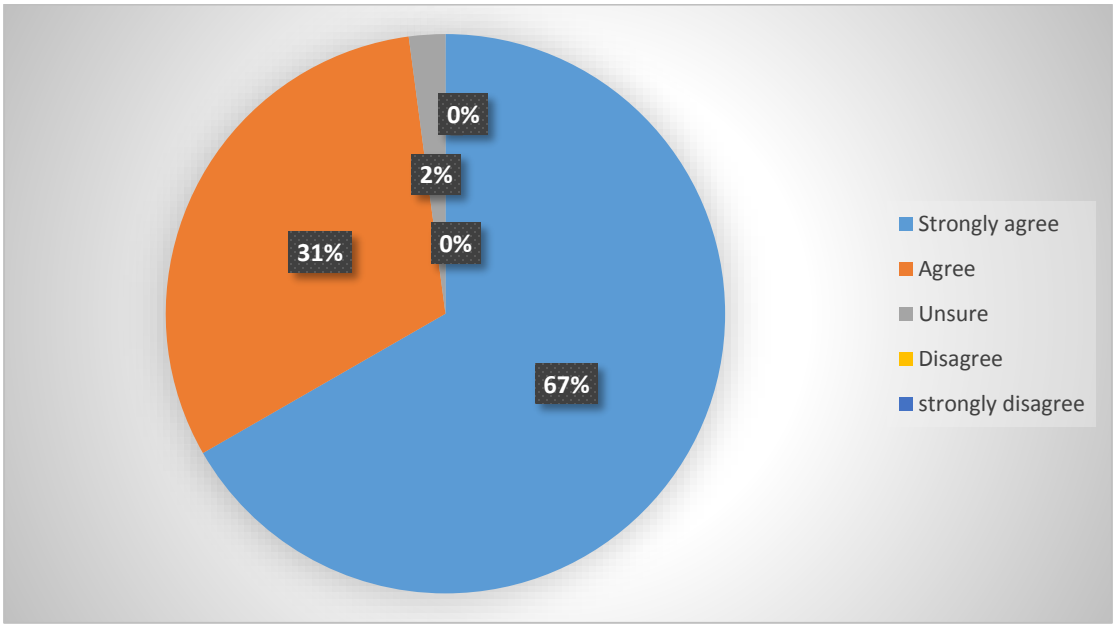

Figure 5.4: Ability of IPD to deliver project efficiently in ZCI.

The general point of view of respondents concerning the totality of contractual principles, and IPD catalysts was significantly positive. The respondents where highly supportive of the IPD approach as a method that can help deliver project successfully in ZCI. The results of this report corroborate with the results of the survey conducted by (Change & Allison, 2016) where the distribution of responses were weighted heavily toward the most positive answers in support of IPD approach. To express the encouraging experience that these respondents had, the likelihood to use IPD again and to recommending IPD as a delivery

methodology to others was also significantly positive. The positive perception of respondent was consistent across all demographic group.

5.4 Summary

This chapter presented and analyzed results from the questionnaire survey and discussed the findings. Firstly, the chapter analyzed the percentage of approval or disapproval of respondents on IPD principles and respondent's point of view on the impact of these principles for ZCI if they were adopted. Finally, the chapter discussed the results concentrating on the comparison of survey finding, literature review and case studies. The chapter exposed a number of elements collaborating in different phase, concerning essentially the positive perception of respondents on capacity of IPD principles to help deliver efficient construction projects in ZCI and other elements such as the big room concept. It has also critiqued elements that were contradictory such as the presence of a "no sue" clause in the contract. The following chapter concludes the research with recommendations.

CHAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

The previous chapter presented and discussed the finding by connecting them to the arguments contained in the literature and the analyzed case studies. This chapter concludes this investigation and gives brief, unambiguous, and realistic recommendations based on opinions supported by the research's results.

6.2 Conclusions

This research proposed to investigate the application of IPD for ZCI. As a starting point this paper produced beneficial information on the current state of the construction industry all over the world including the particular challenges faced by ZCI, in order to establish the background of the study. Through a descriptive, exploratory and explanatory development, studies from other scholars including those published by recognize professional institutions operating in the construction industry were examined. This process explored IPD in all potential areas and facilitated the identification of the gap. Further, the methodological approach described tools and instruments used to collect and analyze data.

The analyzed case studies gave a comprehensive material on the implementation process of IPD. The analyzed fundamental IPD principles described in detail the contract form used and how parties modified it to fit their specific objectives. These modifications gave a specific character to each projects with many and essential lessons learnt for this study. This development gave evidence of the existence of a variety of valuable practices which can help deliver a successful construction project using the same IPD multi-party contract (standard form). The study produced as well evidence of the ability that IPD has to employ multiple strategies to achieve high performing projects in different area and with different teams.

Having the right team appears to be the convergent element in the comments of those that have experienced IPD. The persuasion is that, IPD success is tied to putting together the

right team of people, and the achievement of any group depends on the truthfulness and commitment of team members to collaborate. Other elements such as big room concept, jointly developed project goals, early involvement of key participants, and interoperability of software, concepts that allows to manage and detect problems during the time where the interventions and changes will not have a significant impact on the cost were analyzed.

6.2.1 Type of Contract Agreement Used by IPD

The study findings show that signing the multi-party contract is considered as the starting point and the foundation for the use of IPD principles in a construction project, when parties agree to go for a collaborative structure. Two documents describe the IPD multi-party agreement:

i. The ConcensusDocs300 (standard form).
   Developed by entities representing a wide cross-section of the construction industry which gives details of rights and conditions of signing parties, and

ii. The Sutter Health IFOA.
   This one is a modified ConcensusDocs300 adequate for health care projects.

Organizations that approved this document felt that ConsensusDocs300 traduced a fair and reasonable consensus between the collaborating parties in the allocation of risks and responsibilities in order to appropriately balance the critical interests and anxieties of signing parties (AIA, 2007). In the same vein the legal and insurance communities recognized that as long as the risks are clearly assigned, the necessary support can be provided from any legal entity (ACCL, 2008).

The findings show that users of this document must review and adapt these documents to meet their particular needs, the specific requirements of the project, and applicable laws. It also shows that consulting legal, insurance and surety advisors before modifying or completing these documents can be of great benefit.

6.2.2 Basic Principles of IPD

For the purpose of this study, the following principles were considered as imperative for an IPD project:

1. Shared risk and reward
2. Liability waivers
3. Fiscal transparency
4. Early involvement of key participants
5. Jointly developed project goals
6. Collaborative decision-making
7. Multi-party agreement
8. Building information modeling
9. Co-location of team

These nine basic principles were considered fundamental because they are binding and not just aspirational and based on intent to interact openly and collaboratively. Obtained results also shows that, these nine principles amend the basic traditional contract form and liability relationships. They generate incentives and a structure of consequences arising from the application or ignorance of practices and principles of collaboration. The described nine basic principles appear among others principles in The American Institute of Architect (AIA), the Associated General Contractors of America (AGCA) and Lean documents on the IPD, but are the ones to be often repetitive in various documents.

6.2.3 Perception of Zambian Construction Practitioners on IPD Principles

Case studies lesson learnt and a thorough analysis of the IPD standard contract provided enough element to construct a survey questionnaire which assessed Zambian construction practitioners' appreciation of IPD principles. Study findings show that the assessment of the perception of Zambian construction practitioners toward IPD principles was significantly positive. 97.9% of respondents perceived that the adoption and application of IPD principles to deliver construction projects in Zambia will help meet owner's expectations in terms of time, cost and quality. Findings from this process also traduced an overwhelming desire to collaborate in a new and different structure than the one proposed by the traditional delivery method.

The aim of this study was achieved in the development of different research objectives. Yes, there is more room to learn, and IPD method needs more and various backgrounds analysis for its implementation in different countries, and particularly in Zambia. Empowerment of decision makers in the construction sector through a certain number of anticipatory measures to deal with limitations of IPD implementation will make IPD structure adequate and appropriate for ZCI.

6.3 Recommendations

Based on the literature review, lesson learnt from the case studies and findings, this research recommend the following elements:

i. Professional institutions such as Surveyors Institute of Zambia (SIZ), Association of Consulting Engineers of Zambia (ACEZ), Engineering Institution of Zambia (EIZ), and Zambia Institute of Architects (ZIA) should promote IPD benefits by training their members on different type of IPD contractual agreement and IPD basic principles in order to familiarize with this new approach.

ii. Public Institutions in the construction sector, policy makers such as Zambian Public Procurement Authority (ZPPA), National Council for Construction (NCC), regulators and local authorities should conduct further studies that can allow IPD to fit in the current procurement structure, in order to satisfy teams that are willing to experience IPD in their project. Introducing IPD, while using the existing procurement system can lead to cartel tendering, favoritism and finally close the door to new firms to enter the market.

iii. Local authorities should take the risk to conduct pilot projects with IPD, which will be used as learning experience as it was done for the four case studies analyzed in this document.

6.4 Contribution to the Body of Knowledge

This study added the following elements to the body of knowledge:

i. IPD basic principles detailed in this study constitute a contribution to the body of knowledge, knowing that the opinion of professional institutions in the construction industry remain ambiguous on which principle is supposed to be or not be in the agreement. This study combined principles that are repetitive in various IPD projects and documents to build a set of imperative principles that defines an IPD project.

ii. This study exposed the perception of Zambian construction practitioners toward IPD. The important positive perception translate a fundamental need for more collaboration, which implies a necessity for a certain number of changes in the way thing are currently done.

iii. This study gives more evidence on one of the major problem characterizing the construction industry all over the word. The construction industry is described as being resistant to change. IPD is a delivery approach which has proved its ability to prevent conflictual relationship and overwhelmingly met stakeholder's expectations, which is unusual in construction projects, but its adoption is still slow.

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APPENDICES

APPENDIX I: LETTER SEEKING AUTHORITY TO CONDUCT THE RESEARCH

The University of Zambia

Directorate of Post Graduate Research Department

P.O. Box 32379

LUSAKA

……

……

To: The Managing Director

……Company

RE: RESEARCH STUDY FOR MASTERS' STUDENT: KABEMBA NGOY STEVE

The bearer of this letter, Kabemba Ngoy Steve computer number 2016146074 is a duly registered student at the University of Zambia, School of Engineering.

He is pursuing a Masters of Engineering in Construction Management. The program has a fieldwork component which he has to complete. He is therefore seeking your authority to allow him carry out an educational research in your organization on Analyzing the Application of Integrated Project Delivery for The Zambian Construction Industry.

Yours faithfully,

HEAD OF DEPARTEMENT

APPENDIX II: QUESTIONNNAIRE

THE UNIVERSITY OF ZAMBIA

SCHOOL OF ENGINEERING

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

Research Topic:

Analyzing the application of Integrated Project Delivery (IPD) for the Zambian Construction Industry

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Be assured that the information am collected, will be used purely for academic purposes and will be treated with maximum confidentiality.

In order to participate you will need to give your informed consent. By ticking the boxes you are indicating that you understand the nature of the survey and that you agree to participate in the research.

Please tick the following points if you agree to take part voluntarily

I understand that I have been provided with an explanation of the survey in which I am participating and have been given the name and telephone number of an individual to contact if I have questions about the research.

☐

I understand that participation in the survey is voluntary and that I can withdraw at any time

☐

INSTRUCTIONS

1. Do not indicate your name on the questionnaire.
2. Please tick the correct box in the table provided.

SECTION A: DEMOGRAPHIC CHARACTERISTICS

Please answer all the questions. Choose only appropriate answer(s) by ticking.

1. **Please indicate the highest level of academic qualification obtained**
   O'level: [ ]
   Certificate: [ ]
   Diploma: [ ]
   Bachelors Degree: [ ]
   Masters Degree: [ ]
   Doctorate: [ ]
2. **Position (please tick the correct box)**

Construction Manager	Civil or construction engineer	Contract administrator	Site agent	Project manager	others

If others please specify**……**

3. **Category of company (please tick the correct box)**

Contractor		Consultant		other	

If others please specify**……**

4. **How long have you been working in or with a construction company**

0 – 1year	1 – 5years	5 – 10years	10 – 15years	15 – 20years	Above 20 years

SECTION B: Contractual principles (those that are written into agreements)

Key: Strongly Agree = 1; Agree = 2; Ensure = 3; Disagree = 4; Strongly Disagree = 5

No.	Questions	1	2	3	4	5
5.	Having key participants bound together as equals, whether it is a minimum group of Owner, Architect and Contractor, or a broader group including major subcontractors is essential to project success.					
6.	Contractually defined relationship between key participants to the project as equals, supports collaboration and consensus-based decisions.					
7.	Tying fiscal risk and reward to overall project outcomes, encourages participants to engage in “best for project” behavior?					
8.	Liability waivers between key participants impact positively the project outcome.					
9.	The existence of a "no sue" clause between key participants in the contract, impact positively the project outcomes and the behavior of participants.					
10.	The agreement to use only alternative dispute resolution help to manage construction project smoothly.					
11.	Fiscal transparency between key participants, positively impact the project outcome.					
12.	The existence of a clause requiring and maintaining an open book environment in the contract increases trust and keeps contingencies visible and controllable.					
13.	Early involvement of key participants (owner, architect, contractor, and subcontractors) allows greater understanding of the project features and reduce its complexity.					

No.	Questions	1	2	3	4	5
14.	Requiring all participants essential to project success to be at the table early allows greater access to pools of expertise and better understanding of probable implications of design decisions.					
15.	Greater team investment in design efforts prior to construction increases capacity to achieve all desired project goals.					
16.	Intensified design prior to construction allows greater opportunities for cost control as well as enhanced constructability.					
17.	Jointly defining and carefully developing project goals with the input and support of all key participants increases the chance of them being achieved.					
18.	Jointly defining performance criteria ensures maximum attention will be paid to the project in all dimensions.					
19.	Requiring key project participants to work together on the decisions making process leverages pools of expertise.					
20.	Requiring key project participants to work together on the decisions making process encourages joint accountability and more responsible behavior.					

SECTION C: Behavioral Principles (those that are necessary for project optimization but are ultimately choice-based)

Key: Strongly Agree = 1; Agree = 2; Ensure = 3; Disagree = 4; Strongly Disagree = 5

no	Question	1	2	3	4	5
21.	Working in a non-mutual respect and trust can erode project performances.					
22.	Working in a non-mutual respect and trust pushes participants to act according to what best for them than best for the project.					

no	Question	1	2	3	4	5
23.	Collaboration is a behavioral choice which is supposed to be nurtured between project participants.					
24.	Promoting practices and principles that encourages project participants to collaborate lead to a willingness to adopt a collaborative behavior.					
25.	Lack of open and honest communication in a project hinders opportunities for innovation.					

SECTION D: Catalysts for Integrated Project Delivery (that can be greatly beneficial for optimizing project results)

Key: Strongly Agree = 1; Agree = 2; Ensure = 3; Disagree = 4; Strongly Disagree = 5

No	Questions	1	2	3	4	5
26.	The use of (Building Information Modeling) BIM can coordinate the project more effectively.					
27.	The use of BIM can help gain more time by enhancing collaboration, information sharing and streamline project design and construction.					
28.	Working in the same room to solve project issues increases opportunities for collaboration and innovation.					
29.	Co-location of project participants allows to understand better what the other parties are doing and at the same time have a clear picture of the overall project.					
30.	Do you think that a multi-party contract between key project participants based on all the principles you have strongly agreed or agreed with, can greatly impact project outcomes?					

No	Questions	1	2	3	4	5
31.	Do you think that having a contract based on the contractual principles you have strongly agreed or agreed with, can help deliver project successfully in the Zambian construction industry?					

THANK YOU FOR YOUR PARTICIPATION

APPENDIX III: CASE STUDIES PROJECT DATA

CASE no 1: AUTODESK INC. AEC SOLUTIONS DIVISION HEADQUARTERS

Project Data

Project name and location	Autodesk AEC Headquarters
Building type	Interior office fit-out
Owner	Autodesk Inc.
Year begun	May 2008
Year completed	January 2009
Form of agreement	Multi-party contract
Architect	KlingStubbins
Structural	Simpson, Gumpertz & Heger (not engaged in IPD agreement)
MEP	KlingStubbins
Landscape Arch	N/A
Lighting	LightTHISI (not engaged in IPD agreement)
Builder	Tocci Building Companies
MP/FP	J.C. Cannistraro (IPD subcontractor)
Electrical	Interstate Electrical Services (IPD subcontractor)
Drywall	Tenant Systems (IPD subcontractor)
	(Other subcontractors were not part of IPD agreement)
Initial schedule	
Design	Start: 4/23/08
Construction	Occupancy: 12/16/08
Achieved schedule	
Design	Start: 5/1/08
Construction	Occupancy: 1/23/09
Programmed GSF	50,000 SF
Final GSF	55,000 SF (program breakdown and related $/SF changed)
Budget cost	
Design[1]	N/A
Construction[1]	N/A
Contract cost	
Design[2]	$1,231,000
Construction[3]	$12,223,000
Final cost	
Design[4]	$1,221,000
Construction[4]	$12,117,000
Scope changes	
Owner-initiated[5]	3
Other	0
RFIs	Procurement clarifications: 76 Construction detail clarifications: 49 Total: 125
Sustainability Goal	LEED-CI 2.0 Platinum Certified
Sustainability Achieved	LEED-CI 2.0 Platinum Certified

[1]Under IDP, programming and scoping were integrated into the overall project process as design proceeded. Therefore, there was no traditional "budget" for the project; a target cost was developed and converted into contract cost.

[2]Design budgets were originally set by traditional profit targets; this number includes all A/E fees at direct cost, plus incentive payments as targeted.

[3]As this was primarily an FF&E project with significant MEP and telecom infrastructure (and an atrium) under the IPD model this number included all costs not associated with design, including hard cost, furniture, fixtures, and equipment, construction management, and incentive payments made to the build team.

[4]Final design and construction costs at completion were below the contract target. A/E and Builder profits exceeded original projections, and final construction quality exceeded the base requirements, a "triple win" for the project.

[5]The "pure" IPD model had no provision for change orders, but there were owner-initiated scope additions.

CASE no 2: SUTTER HEALTH FAIRFIELD MEDICAL OFFICE BUILDING

Project Data

Project name and location	Sutter Regional Medical Foundation Medical Office Building #2, Fairfield, California
Building type	Medical Office Building
Project description	3 Story - 69,948 SF with clinical, administrative, and shelled space.
Owner	Sutter Regional Medical Foundation, Sutter Health
Year begun	July, 2005
Year completed	November, 2007
Form of agreement	Multi-party contract
Architect	HGA
Structural	HGA
MEP	Southland Industries Rosendin Electric
Landscape Arch	MTW Group
Other designer	HGA
Builder	Boldt
MEP	Southland Industries Rosendin Electric
Curtain wall	Progress Glass
Major subs	A & B Painting Air Systems American Tile & Brick Anning – Johnson Davison Iron Works Diablo Landscape Enterprise Roofing Forderer Ireland Interior Systems R E Maher B T Mancini Mission Bell Otis Elevator Systems Tech Top Grade Construction
Initial schedule	
Design	SD (2 months) 10/05 – 1/06 DD (3 months) 1/06 – 3/06 CD Phase I (3 months) 4/06 – 7/06 CD Phase II (6 months) 4/06 – 10/06
Construction	Phase I (4 months) 8/06 – 12/06 Phase II (11 months) 12-06 – 11/07 (15 months total)
Achieved schedule	
Design	SD (2 months) 10/05 – 1/06 DD (3 months) 1/06 – 3/06 CD Phase I (3 months) 4/06 – 7/06 CD Phase II (6 months) 4/06 – 10/06
Construction	(15 months total) 8/06 – 11/07 (3 month delay for program revision)
Programmed GSF	67,106 SF
Final GSF	69,948 SF
Budget cost	
Design[1]	Design information not supplied
Construction[2]	$19,017,180
Contract cost	
Design[1]	Design information not supplied
Construction[2]	$19,573,035
Final cost	
Design[1]	Design information not supplied
Construction[2]	$19,462,103

CASE no 3: ENCIRCLE HEALTH AMBULATORY CARE CENTER

Project Data

Project name and location	Encircle Health Center Appleton, WI
Building type	Ambulatory Care Center, with Endoscopy center Imaging center Medical offices Pharmacy/Café/Conference area
Owner	NAACC Building Co. LLC and ThedaCare
Year begun	2006
Year completed	2009
Form of agreement	Multi-party contract
Architect	HGA
Structural	HGA
MEP	HGA/August Winter (M,P), Town and Country (E), Excellence Elec. (LV & Security), Ahern (FP)
Landscape Arch	Martenson and Eisele
Other designer	HGA (Interiors), Martenson and Eisele (Civil)
Builder	O. J. Boldt Construction
MEP	August Winter (M,P) Town and Country (E) Excellence Elec. (LV), Ahern (FP)
Curtain wall	Corcoran Glass
Major subs	O. J. Boldt, F.C. Dadson (Millwork), Builders Service (Door/Hardware), Nimsgern (Struct Steel), Macco's (Flooring), Omni Glass & Paint (Wall Finishes)
Initial schedule	
Design	May 2006 thru January 2009
Construction	July 2008 thru July 2009
Achieved schedule	
Design	May 2006 thru January 2009 (5 month delay due to formation of business model with physicians)
Construction	September 2008 thru October 2009
Programmed GSF	150,000 SF
Final GSF	157,000 SF
Budget cost	
Design[1]	$2,657,820
Construction[2]	$34,094,999
Contract cost	
Design[1]	$2,901,071
Construction[2]	$34,977,404
Final cost	
Design[1]	$3,185,917
Construction[2]	$35,408,131
Change orders	
Owner-initiated	$1,514,911
Other	-0-
RFIs	-0-
Sustainability Goal	LEED Silver
Sustainability Achieved	LEED Gold (not final as of this writing but team was confident it would be achieved.)

[1]Total design fees including all subconsultants and owner-selected consultants.

[2]Construction hard costs excluding furniture, fixtures, and equipment (FF&E) but including general conditions, CM fees including preconstruction services.

CASE no 4: WALTER CRONKITE SCHOOL OF JOURNALISM

Project Data

Project name and location	Walter Cronkite School of Journalism and Mass Communication – KAET 8 Phoenix, Arizona
Building type	Classroom / office building, on-air production public TV and radio station
Project description	The program was driven by the diverse needs of the School of Journalism, the university-operated public television station KAET/Channel 8, with the addition of general university classrooms and ground floor retail. Though served by a common lobby, each required its own distinct identity. In addition, the project needed to accommodate an electrical substation and internal delivery bays on the first floor. The School of Journalism and KAET/Channel 8 cameras each required super-flat floors in the studios and roof-mounted satellite and microwave dish arrays. KAET/Channel 8 and the Cronkite School each required studios, control rooms, master control room, editing suites, post production suites, computer labs, and television-ready classrooms, as well as many other technival support spaces. Components of the Walter Cronkite School of Journalism include:3,000 SF multi-level Forum with remote-operated cameras and HD rear-projection screen • 3 working newsrooms • 2 television studios with associated video production and audio control rooms • 23 TV edit bays • Radio studio and control room • 9 Radio edit bays • 7 digital computer labs • 150-seat, theatre-style auditorium with remote-operated cameras • 1,500-square-foot gallery dedicated to journalism history The Cronkite School occupies all of the second and third floors and a portion of the fourth and sixth floors. The newsroom and broadcast anchor desks are contained within one production space with views overlooking the city. Additionally, heavily mediated and camera-ready classrooms were required for distance learning. KAET/Channel 8 occupies the entire fifth floor of the building, a portion of the fourth floor and transmits from studios on the sixth floor. This top floor location uses long spans and high ceilings as required by the studios. Satellite dishes for transmission and reception are housed on the roof; they are not screened and serve to express the building's communication function. Components of KAET / Channel 8 include: • 1 – 5,400 SF and 1-2,400 SF television production studios with associated video production and audio control rooms • Master Control Room and equipment rack room • 4 edit suites and 2 post production edit suites • KBAQ radio studio and control room • 2 radio production edit suites
Owner	City of Phoenix – Owner/Developer
Year begun	2006
Year completed	2008
Form of agreement	Design-build
Architect	HDR Architecture, Inc. and Ehrlich Architects
Structural	CTS – Caruso Turley Scott, Inc.
MEP	HDR Architecture, Inc.
Landscape Arch	Ten Eyck Landscape Architects
Other designer	Dibble Engineering – Civil Engineers
Builder	Sundt Construction – Design Builder Self-performed civil and structural concrete work
MEP	University Mechanical & Engineering Contractors, Inc., Kearney Electric, Western States Fire Protection
Curtain wall	KT Fabricators
Major subs	Performance Contracting – Framing and Drywall Thyssen Krupp - Elevators Resource Flooring T-P Acoustics, Inc. – Acoustical ceilings Commercial Door & Hardware Elward Construction – Metal Panel System Schuff Steel – Structural Steel Ironco – Misc. & Structural Steel Rhino Masonry – Masonry RBG Construction – Site/Offsite Concrete

Initial schedule	Design and Construction – 21.4 Months
Design	Notice to proceed through tenant fit-up permit – 10.8 months
Construction	From 1st permit issued to certificate of occupancy – 16 months
Achieved schedule	Design and Construction – 19.8 Months
Design	Notice to proceed through tenant fit-up permit – 9.4 months
Construction	From 1st permit issued to certificate of occupancy – 15 months
Programmed GSF	200,000 to 260,000 GSF
Final GSF	230,000 GSF
Budget cost	Total project budget = $71,000,000 bond funded building plus miscellaneous bond funded offsite improvements and art projects.
Design[1]	Design, owner soft costs & owner contingencies - $16,022,000
Construction[2]	Construction - $54,978,000
Contract cost	
Design[1]	$7,910,994
Construction[2]	$57,957,728
Final cost	
Design[1]	$8,276,450
Construction[2]	$63,822,794
Change orders	
Owner-initiated	Total Added Scope from City of Phoenix Contingency - $1,351,334
Other Budgets	Total Added Scope from Other Budgets = $4,513,732
Added value changes	from design-builder contingency = $1,556,236 from owner allowance = $2,402,926
RFIs	454, of which about 25% were confirming RFIs for documentation purposes.
Sustainability Goal	LEED Silver
Sustainability Achieved	LEED Silver, 2 Green Globes Achieved

[1]Total design fees including all subconsultants and owner-selected consultants.

[2]Construction hard costs excluding furniture, fixtures, and equipment (FF&E) but including general conditions, CM fees including preconstruction services.