T.R

MIMAR SINAN FINE ARTS UNIVERSITY INSTITUTE OF SCIENCE AND TECHNOLOGY

TRANSITIONING TO INTERGRATED PROJECT DELIVERY

M. Sc. Thesis by

Begüm KARAMANOĞLU, Architect

Division of Structural Engineering

Programme of Construction Project Management

Supervisor: Prof. Dr. Selin GÜNDEŞ

JANUARY 2022

T.C
MİMAR SİNAN GÜZEL SANATLAR ÜNİVERSİTESİ
FEN BİLİMLERİ ENSTİTÜSÜ

ENTEGRE PROJE TESLİMİNE GEÇİŞ

YÜKSEK LİSANS TEZİ

Mimar Begüm KARAMANOĞLU

Yapı Mühendisliği Anabilim Dalı

Yapım Proje Yönetimi Programı

Tez Danışmanı: Prof. Dr. Selin GÜNDEŞ

OCAK 2022

Mimar Sinan Güzel Sanatlar Üniversitesi Fen Bilimleri Enstitüsü tez yazım klavuzuna uygun olarak hazırladığım bu tez çalışmada;

- tez içindeki bütün bilgi ve belgeleri akademik kurallar çerçevesinde elde ettiğimi,
- görsel, işitsel ve yazılı tüm bilgi ve sonuçları bilimsel etik kurallarına uygun olarak sunduğumu,
- başkalarının eserlerinden yararlanılması durumunda ilgili eserlere bilimsel normlara uygun olarak atıfta bulunduğumu,
- atıfta bulunduğum eserlerin tümünü kaynak olarak gösterdiğimi,
- kullanılan verilerde herhangi bir değişiklik yapmadığımı,
- ücret karşılığı başka kişilere yazdırmadığımı (dikte etme dışında), uygulamalarımı yaptırmadığımı,
- ve bu tezin herhangi bir bölümünü bu üniversite veya başka bir üniversitede başka bir tez çalışması olarak sunmadığımı

beyan ederim.

....

To my little son who has a big soul,

ACKNOWLEDGEMENTS

First of all, I'd like to give my special thanks to my supervisor, Prof. Dr. Selin Gündeş. Throughout this difficult path, I felt her guidance, patience, support and encouragement. Without her experiences, I wouldn't achieve to complete such a study.

Secondly, I would like to thank to Mr. Ali Solaksubaşı, Mr. Ted Oberlies, Mr. Sean Ruwart, Mr. Samir Emdanat, Mr. Frank Mullaghy, Mr. John Lohan and Mr. Ron LaDuke for their added value on this thesis.

I also would like to thank Mr. Cenk Tunaboylu who introduced the concept to me, which I decided to study for my thesis.

I'd like to offer my heartfelt gratitude to my family, who always believed in me and believed that I could do anything. Finally, special thanks to my son, who always gives me strength, encouragement, true love, and self-belief despite being just six years old.

TRANSITIONING TO INTEGRATED PROJECT DELIVERY

ABSTRACT

Today's construction environment involves the execution of increasingly complex, uncertain projects, which necessitates project teams working under tight schedules and with limited resources. Many studies on construction contracting systems have found the same conclusion: building scopes are expanding and the use of technology in the sector is becoming increasingly crucial; however, traditional contracting systems are falling short of meeting the needs of this expanding industry.

Traditional delivery systems are typically used for construction projects: Design–Bid–Build (DBB), Design-Build (DB), or Construction Management at Risk (CMR). These methods also fail to satisfy the client due to longer project durations, overruns, poor quality of finished works, and recurring health and safety incidents. Among the stated issues with traditional construction procurement methods are frequent conflicts, aim discrepancy, change orders, rework, antagonistic relationships, arbitrations, and litigations. Over the past two decades, many experts, analysts, and building and management practitioners have collaborated to provide a broad variety of ideas and strategies to solve the problems related to project delivery methods. Inadequate collaboration and cooperation among project's primary actors resulted in the emergence of systems based on relational contracts such as 'partnering' and 'project alliancing'. The success of these two systems consequently led to the accomplishment of a novel phenomena called the 'integrated project delivery system'.

Integrated Project Delivery (IPD) is a revolutionary project delivery system that attempts to resolve waste concerns, inefficiencies, and adversarial relations in the Architecture-Engineering-Construction (AEC) industry while increasing project success. Even though various professional organizations support for more widespread use of IPD, and previous research has proved the benefits and challenges of it, the number of projects that use it is still limited.

While the construction industries in developed countries are improving their practice using IPD to solve the problems related to traditional methods, the Turkish construction environment is unfamiliar with the IPD concept. Therefore, the primary goal of this research is to make inferences that can shed light on Turkey's transition to IPD through an exploration of critical factors for IPD implementation in the USA. The insights from this research are expected to shed light on the future of IPD usage in Turkey. Revealing the advantages, disadvantages, success factors, and potential barriers to IPD implementation in the construction industry will lead the practitioners and researchers in the preview of potential problems. Recognizing the problems and barriers is important because recognizing is the first step to overcoming barriers. Case studies and interviews with IPD practitioners are expected to help on further understanding on IPD through USA example.

Keywords: integrated project delivery, traditional delivery methods, Turkish construction industry

ENTEGRE PROJE TESLİMİNE GEÇİŞ

ÖZET

Günümüz inşaat atmosferi, giderek daha karmaşık, belirsiz projelerin yürütülmesini içermekte ve bu da proje ekiplerinin sıkışık iş programları ve sınırlı kaynaklar ile çalışmasını gerektirmektedir. Proje teslim sistemleri üzerine yapılan birçok çalışma aynı sonuca varmıştır: inşaat kapsamları genişlemekte ve sektörde teknolojinin kullanımı giderek daha önemli hale gelmekte iken geleneksel proje teslim sistemleri inşaat endüstrisinin artan ihtiyaçlarını karşılamakta yetersiz kalmaktadır.

İnşaat projeleri tipik olarak geleneksel yöntemler kullanılarak teslim edilir: tasarla-ihale et-inşa et, tasarla-inşa et veya risk altında yapım yönetimi. Bu yöntemler uzayan proje süreleri, maliyet aşımları, tamamlanan işlerdeki düşük kalite ve yinelenen iş sağlığı ve güvenliği kazaları nedeniyle işverenleri memnun edememektedir. Sıklıkla yaşanan anlaşmazlıklar, hedef tutarsızlığı, değişiklik emirleri, yeniden çalışma, çekişmeli ilişkiler, tahkimler ve davalar, geleneksel proje teslim yöntemleri ile ilgili bildirilen sorunlar arasındadır. Son yirmi yılda, birçok uzman, analist, bina ve yönetim uygulayıcısı, proje teslim yöntemleri ile ilgili bildirilen bu sorunları çözmek için işbirliği yapmakta. Projelerin ana aktörleri arasındaki zayıf işbirliği, ilişkisel sözleşmeye dayalı 'ortaklık' ve 'proje ittifakı' gibi yöntemlerin ortaya çıkmasına neden oldu. Bu iki yöntemin başarısı da yeni bir fenomenin, 'Bütünleşik Proje Teslimi'nin ortaya çıkmasına yol açtı.

Yeni bir proje teslim yöntemi olarak Bütünleşik Proje Teslimi (BPT), mimarlik-mühendislik-inşaat sektöründeki atık endişelerini, verimsizliği ve düşmanca ilişkileri çözmeyi ve projenin başarı potansiyelini arttırmayı amaçlamaktadır. Çeşitli mesleki kuruluşlar BPT'nin daha yaygın kullanımını desteklese ve önceki araştırmalar bu sistemin zorlukları ile birlikte yararlarını kanıtlamış olsa da, BPT kullanan projelerin sayısı hala sınırlıdır.

Gelişmiş ülkelerdeki inşaat endüstrileri, geleneksel yöntemler ile ilgili sorunları çözmek için BPT kullanarak uygulamalarını geliştirirken, Türk inşaat çevreleri bu kavrama henüz yabancıdır. Bu araştırmadan elde edilen anlayışın Türkiye'de BPT

kullanımının geleceğine ışık tutması beklenmektedir. İnşaat endüstrisinde BPT uygulamasındaki avantajları, başarı faktörlerini, zorlukları ve potansiyel engelleri ortaya çıkarmak, uygulayıcı ve araştırmacılara potansiyel sorunların önizlemesinde yol gösterici olacaktır. Sorunları ve engelleri tanımak önemlidir çünkü tanımlamak, engeli aşmanın ilk adımıdır. Vaka çalışmaları ve BPT uygulayıcıları ile yapılan görüşmelerin ABD örneği üzerinden BPT'ni daha iyi anlamaya yol açması beklenmektedir.

Anahtar kelimeler: bütünleşik proje teslimi, geleneksel teslim yöntemleri, Türk inşaat sektörü

TABLE OF CONTENTS

Page

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

AEC	Architecture-Engineering-Construction
AGC	Associated General Contractors of America
AIA	American Insitute of Architects
BOT	Build-Operate-Transfer
BIM	Building Information Modeling
CAD	Computer Aided Design
CM	Construction Manager
CMR	Construction Manager at Risk
CMAA	the Construction Management Association of America
CURT	the Construction Users Roundtable
DB	Design-Build
DBB	Design-Bid-Build
ELT	Executive Leadership Team
FIDIC	Fédération Internationale Des Ingénieurs-Conseils
GC	General Contractor
GDP	Gross Domestic Product
IPD	Integrated Project Delivery
NIST	U.S.National Institute of Standards and Technology
PLT	Project Leadership Team
RFI	Request For Information
ROI	Return on Investment
USA	United States of America
TOC	Total Output Cost

1 INTRODUCTION

All projects from the simplest buildings to the most complex infrastructure require experts and companies to be part of comprehensive activities for design and construction. The group of experts required by a certain project can either be small or big depending on the intricacy of the project under question. The construction environment of today embraces the completion of increasingly complex, uncertain projects that require project teams to work under tight schedules and with limited resources. Many researches on construction contracting systems had studied out the same point: scopes of buildings are getting larger and the use of technology in the industry is getting more important day by day; however traditional contracting systems fall short in fulfilling the needs of this growing industry (Abadi, 2015; Williams, 1999; Matthews & Howell, 2005; Nawi et al., 2014; Bilbo et al., 2015; Lichtig, 2006; Becerik-Gerber & Kent, 2010; Ghassemi & Becerik-Gerber, 2011; Hanna, 2016; Rahim et al., 2016; Hall & Scott, 2019; Perlberg, 2009; Alves & Shah, 2018) Over the past two decades, many experts, analysts, and building and management practitioners have collaborated to provide a broad variety of ideas and strategies for solving the problems related to project delivery methods. Poor coordination and cooperation among project's main actors resulted in the introduction of methods such as ‘partnering’ and ‘project alliancing’ based on relational contracts; therefore, the success of these two methods lead to the accomplishment of novel phenomena ‘Integrated Project Delivery system’ (Abadi, 2015).

In an attempt to deliver effective projects and minimize conflicts under dynamic changes, a new approach called Integrated Project Delivery (IPD) was introduced in the early 1990s in Australia as 'Alliancing' (Durdyev et al., 2019). IPD was initially used for infrastructure projects (Noble, 2007), and it was later agnominated as Integrated Project Delivery by the American Institute of Architects (AIA), as a developed version of the project alliancing (Matthews and Howell, 2005).

The application of IPD in the construction industry in the United States is still in its early phases. IPD, as a new project delivery method, attempts to address waste concerns, adversarial relations in the AEC industry, and inefficiency, as well as improve project success potential (Autodesk White Paper, 2008; DeBernard, 2008; Lichtig, 2006). Proponents argue that IPD will minimize waste and save time and money in building design and construction processes. The Building Information Modelling (BIM) will simplify important design decisions to be developed, evaluated, and tested with BIM tools about the life cycle of the building. Both IPD and BIM help project design and construction processes in increasing productivity and building performance during the building lifecycle which includes planning, designing, constructing, and operating phases of the project (Dilsizoğlu Özperçin, 2016). Despite the fact that several professional organizations promote more widespread use of IPD (AIA, 2007; AIA California Council, 2008; AGC, 2009), and previous research activities have demonstrated its benefits and barriers (Matthews & Howell, 2005; Hellmund et al., 2008; Becerik- Gerber & Kent, 2010; Cohen, 2010), the number of projects using IPD is still relatively limited (Kent & Becerik-Gerber, 2010; Sive, 2009, Sommer et al., 2014; Pishdad-Bozorgi, 2017, Hamzeh et al., 2019).

1.1 Problem Statement

Traditional delivery systems are typically used for construction projects: Design–Bid–Build (DBB), Design-Build (DB), or Construction Management at Risk (CMR) (Mesa et al., 2016; Ma et al., 2018). These methods also fail to satisfy the client as a result of prolonged project timelines, cost overruns, inferior quality of completed works as well as repeated instances of health and safety problems (Lichtig, 2010; Mesa et al., 2016; Hamzeh et al., 2019). Traditional construction procurement methods have been accused of causing frequent conflicts, aim discrepancy, change orders, rework, antagonistic relationships, arbitrations, and litigations. (Ma et al., 2017, 2018; Xie & Liu, 2017; Abdirad & Dossick, 2019). Traditional project implementation approaches fail to provide a guaranteed level of productivity, resulting in improper budgetary planning and material waste. (Jackson, 2011).

Because the construction industry's traditional supply chain is highly fragmented, segmented, and divided into multiple small specialized enterprises, it lacks process integration (Briscoe & Dainty, 2005; Mignone et al., 2016; Harper et al., 2016; Papadonikolaki & Wamelink, 2017). Members of the project team and the companies participating work in isolation and are primarily responsible for their own proportion of the job throughout the project's life cycle, thus they follow their own vested interests. (Atkinson & Westall, 2010; Ghassemi & Becerik-Gerber, 2011; Kibert, 2016). This results in cost overruns, longer project execution timelines, and worse quality built facilities, all of which dissatisfy stakeholders (Durdyev & Mbachu, 2011; Ghoddousi & Hosseini, 2012; Ma et al., 2017; Teng et al., 2019).

Because IPD is a new concept that has not been widely implemented in practice, many researchers have examined and addressed it as an alternate delivery method to fix present challenges, such as poor participant interactions and low productivity due to inefficiency and rework (Thomsen et al., 2009). Although studies about IPD are limited globally, it seems that the subject will increase its popularity in the academic field for better practices day by day.

While the construction industries in developed countries are improving their practice using IPD to solve these problems addressed in many studies mentioned above, to the knowledge of the author, there is no example of an IPD project in the Turkish construction industry yet. Academic studies are also very few, including several articles and less than 10 thesis studies. 3 of these theses focused on the association of IPD usage with sustainable design. 4 of them studied BIM tools related to IPD. Only one thesis studied the Turkish and Middle East's AEC industry's approach to IPD use.

Considering the prevalence of future uses of IPD, it can be seen that studies conducted in Turkey up to today are insufficient. Foreign studies are not applicable for Turkey's construction industry literally because of the following reasons: legal frame disparities, work culture, financial resources. Therefore, Turkey-specific studies should be performed.

1.2 Research Objectives

The primary goal of this research is to make inferences that can shed light on Turkey's transition to IPD through an exploration of critical factors for IPD implementation in the USA. These extractions can lead to verifying a roadmap for the Turkish AEC industry. In the Turkish AEC industry, where IPD's name has yet to be heard, the implementation of this roadmap would be helpful by promoting action to analyze further and enhance today's situation of the industry, as well as taking steps to implement this new project delivery system. The secondary goal of this research is to reveal the advantages, disadvantages, success factors, and potential barriers to IPD implementation in the construction industry. This will also lead the practitioners and researchers in the preview of potential problems. Recognizing the problems and barriers is important because recognizing is the first step to overcoming barriers.

This study attempts to contribute to the knowledge and experience level of construction industry professionals on IPD by including their opinions with a lessons-learned perspective. In this concept, potential barriers that might be faced in IPD implementation in Turkey are revealed, and strategies for overcoming those barriers are developed. The insights from this research are expected to shed light on the future of IPD practices in the Turkish construction industry.

1.3 Method and Data

Figure 1.1 shows the steps involved in the research approach, which are detailed in this section. Regarding these steps, the development of this study consisted of three basic phases as explained below:

1.3.1 Phase 1-Literature Review

In this phase, the literature review method is used as a qualitative method to analyze the principles, benefits, and barriers of IPD implementation in different parts of the world. The previous studies were reviewed on IPD with the aim of two outcomes. The first goal of the literature review was to define the pros and cons, to recognize the difficulties in incorporating this seemingly promising concept in project delivery.

The second goal was to gain an understanding of the existing researches relevant to IPD to construct a foundation and prepare the questions of the semi-structured interview. In the light of these purposes, journals, books, industry case reports, and interviews were researched.

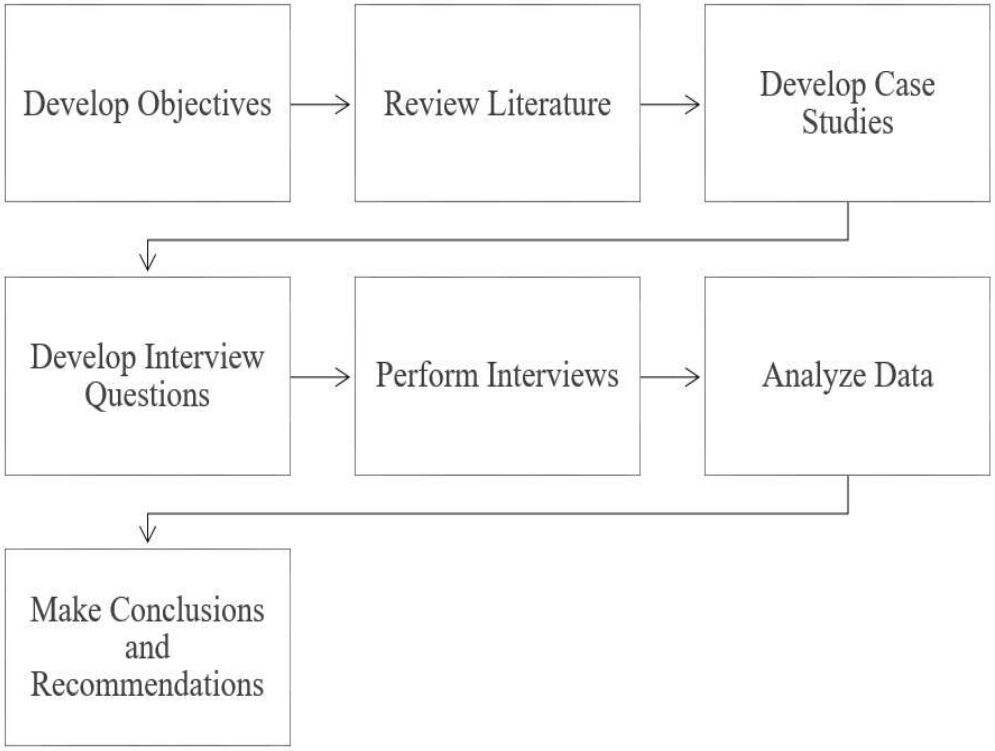

Figure 1.1 Research Methodology Flowchart

1.3.2 Phase 2- Case Studies and Semi-Structured Interviews

In this phase, semi-structured interviews were performed because the author needed more insight to understand stakeholders' viewpoints. Interviews are the most common data collection method in qualitative research (Taylor, 2005), semi-structured interviews are a common data gathering method and the quality of the interview guide has a considerable impact on the study's outcomes (Kallio et al., 2016). The use of semi-structured interviews necessitates some prior research in the research subject area because the interview questions are based on existing knowledge (Wengraf 2001, RWJF 2008, Kelly 2010). Following this knowledge, questions and the format of the interview were generated in accordance with the

collected information in the first phase. The generated format was tested as plot interviews on some professionals who are architects and engineers and detected issues were fixed. Five professionals were interviewed via e-mail and Microsoft Team's online conference platform. Two of them were professionals with IPD experience employed in Ghafari Associates LLC, a USA-based worldwide company for which the author of this thesis has been working for three years. Two professionals were key participants from the contractor and owner side of IPD projects which Ghafari designed. One participant who has relationships with IPD practitioners of Ghafari was communicated via LinkedIn.

1.3.3 Phase 3 – Analysis

With the literature review, possible barriers and potential advantages of IPD in developing countries are obtained. Case studies concluded how beneficial IPD was for the stakeholders through real-life projects in USA. As a conclusion of the semi-structured interviews, the benefits and challenges of IPD and possible transition problems are defined. These findings are then analyzed considering Turkey's specific conditions of legal, cultural, technological differences and variances. The outcomes of this analysis may be used as a roadmap by future studies that aim to generate models for Turkey's smooth transition to IPD. Finally, after a summary of the findings, construction professionals are provided some suggestions to make IPD more accessible in Turkey.

1.4 Organization of the Thesis

This study consists of five chapters. The context of the thesis, problem statement, research goals and objectives, scope, and thesis organization are all introduced in Chapter 1.

Chapter 2 conducts a systematic literature review to present project delivery systems that are globally used, examining traditional project delivery systems with basic principles, advantages, disadvantages. After defining why the construction industry needed a change, IPD is represented with its background, comparison with traditional delivery methods.

In Chapter 3, two case studies of IPD implementation from the USA are performed and discussed through the findings.

Chapter 4 is based on semi-structured interviews. After the interviewees are represented, their answers are discussed with common and opposite sides.

Conclusion based on research findings and recommendations for future works are produced in Chapter 5.

2 TRADITIONAL PROJECT DELIVERY SYSTEMS AND IPD

Project Delivery is ‘a comprehensive process including planning, design, and construction required to execute and complete a building facility or other type of project’. The literature has many existing definitions of a project delivery system. Cho et al. (2010), for example, categorized diverse definitions into three categories: ‘commercial terms, organizational structure, and management system’. However, Sanvido and Konchar (1999) observed that regardless of the tools and methods used, two elements are constantly present in the majority of delivery system descriptions: ‘project stakeholder relationships and their timing of engagement in the project’. Similarly, the paper by El Asmar et al. (2013) defines project delivery as ‘a system that determines the relationships among project stakeholders and the timing of their engagement in order to supply a built facility’.

According to a study done by Ma et al. in 2018, a project delivery method has three general aspects: the organization, the commercial terms, and the operating system. The organization refers to how the project's team members are constituted while looking at these characteristics. The responsibilities and obligations outlined by a contract are referred to as commercial terms. The project's operational term referring to how it is carried out and managed on a schedule.

According to Kenig's study published in 2011, ‘a Project Delivery System is the method of assigning contractual obligations for project design and construction that includes the scope and specifications of a project; the parties' contractual conditions, duties, and liabilities; procedures, actions, and sequences of events; interactions between participants; management mechanisms for time, cost, safety, and quality; forms of agreement and activity reports’.

Although there are many different definitions for project delivery methods in the literature, they all have one thing in common: ‘a way by which a project is contracted for construction’. (Abadi, 2015).

Any owner embarking on a construction project must make one of the most significant decisions of their lives: the project delivery procedure. Every project's preferred option must start with a thorough comprehension of the various methodologies. Owners must also understand the implications of each option because the delivery method determines when parties are engaged, influences contractual relationship choices, and affects ownership and the impact of changes and modifications to project expenses. In all delivery methods, at least three parties must be involved which are owner, designer, and contractor. It is critical to select the most appropriate delivery method that best matches the individual objectives of each owner and project.

The owners are forced by market pressures to choose a delivery method that will strike a balance between the following considerations in determining the project's quality: scope, budget, and schedule.

Choosing the project delivery system is very critical since it is one of the most crucial aspects in achieving these objectives. Therefore, ‘developing a novel and promising project delivery system and testing it in real projects is important in addressing the chronic problems of the construction industry, such as adversarial relationships among project participants, fragmented information that causes inefficiency and errors in the work, and discrepancies between designed products and actual products’ (Yu et al., 2019).

In today's construction industry, a variety of project delivery systems are in operation. Figure 2.1 demonstrates the differences between the DBB, DB, and IPD frameworks, with two key focal areas: relationships between project stakeholders and their time of engagement in the project.

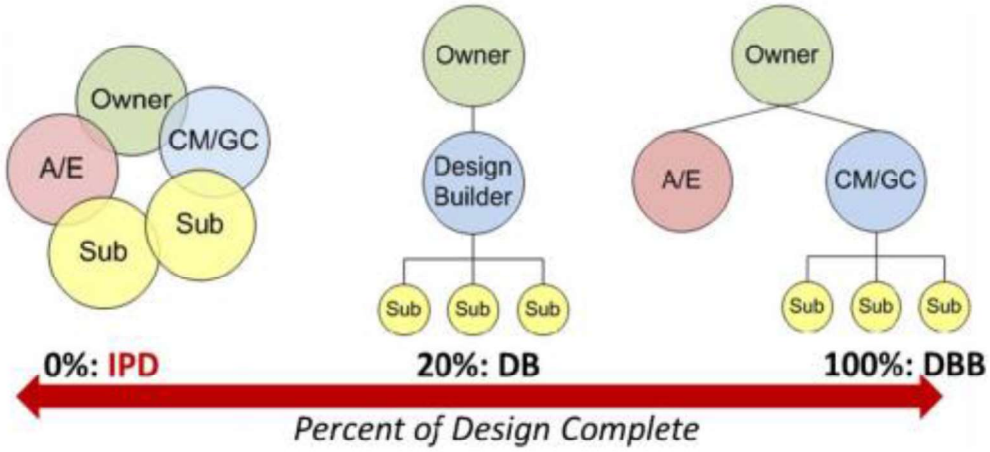

Figure 2.1 Differences between DB-DBB-IPD

Source: El Asmar et al. 2013

DBB is the most well-known and commonly used traditional delivery method. In DBB, the owner hires designers first, then hires a general contractor once the design is finished. DB is a more collaborative system compared to the traditional DBB. The designer and the general contractor (GC) join forces in DB and the contractor is generally engaged in the project when the design is approximately 20% finished (El Asmar et al., 2013).

IPD is one of the latest attempts to generate a new system that aims to overcome the disadvantages of the former delivery systems. As it can be seen in Figure 2.1, IPD is different because all key participants are involved in the project at the very beginning before the design even starts, signing one multi-party contract.

In this chapter, traditional delivery systems are explained with their advantages and disadvantages, their reflections on project cost and schedule to light the way for the pursuit of a new delivery system through a better understanding of problems experienced in traditional systems.

2.1 Traditional Project Delivery Systems

To satisfy changing demands and problems, project delivery methodologies are rapidly developing. Traditionally, a master builder was committed for providing a well-planned and built facility, but a push to regard construction projects as goods

has resulted in the separation of design and construction duties (Sullivan et al., 2017). Architects and engineers have been hired to offer professional plans and specifications since the early twentieth century. Following the completion of the design documentation by the architects and engineers, a contractor is hired to build the previously designed facility, usually at the lowest cost to the owner. The DBB method has become the construction industry's project delivery standard.

Alternative delivery techniques have emerged to address some of DBB's limitations, providing for greater flexibility in the way projects are conceived, procured, and ultimately built. DB and CMR delivery systems have established themselves as viable solutions for construction project delivery in recent years, despite cultural and legislative resistance (Sullivan et al., 2017).

Commonly used project delivery methods in the light of these aspects are explained below:

Design-Bid-Build: The DBB project delivery system was created in the late 1800s in response to a series of allegations of bribery and violence leveled against contractors working on major US building projects such as the transcontinental railroad (Carpenter, 2014). The method was created to minimize the risk of corruption and cost, and it can be used to deliver high-quality outcomes for public and private projects when used properly.

This method is the most commonly used traditional project delivery method which typically involves three consecutive project phases which are the design phase, the bid phase, and the build phase. The design phase necessitates the hiring of a designer as well as the delivery of the tender documentation. The bid phase includes the selection and appointment of the contractor, which will be followed by the construction phase by the selected contractor.

A design firm is selected and hired to provide all design documents to begin. Following the agreement on these documents, the owner seeks competitive tenders to complete the job. Designers and contractors are not obligated to collaborate, and they are not bound by any contractual commitments.

The following are the characteristics that distinguish the DBB:

- Separate contracts exist for design and construction (owner-designer, owner-contractor). Figure 2.2 shows the contractual relationships.
- The total building cost is a consideration when choosing a contractor (AIA-AGC, 2011; Kenig, 2011).

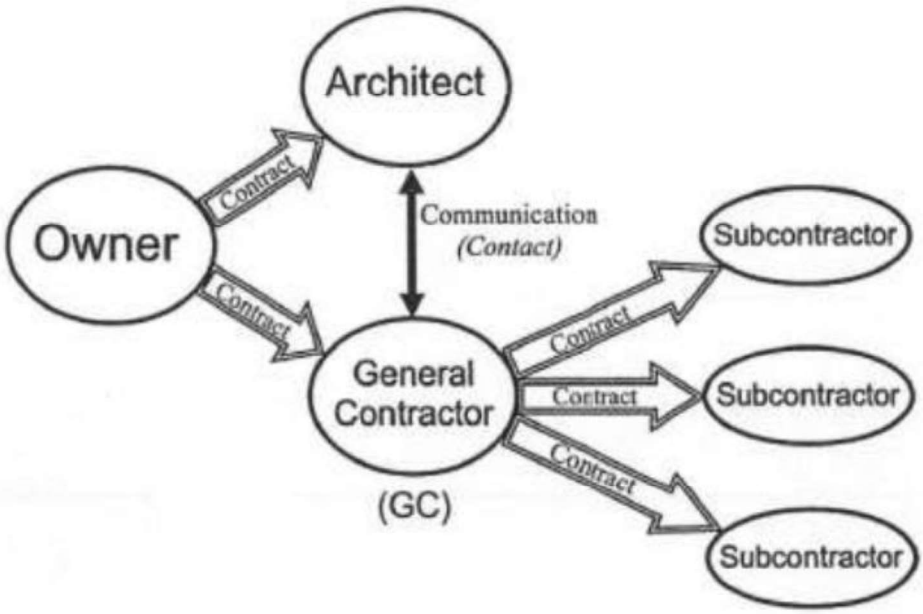

Figure 2.2 DBB Contract Structure (Civitello, 2000)

DBB is best suited to projects that are well-defined and unlikely to alter, well-designed with complete design documentation, and have less than average time constraints (Gordon, 1994).

This method has several drawbacks, including adversarial relationships caused by risk allocation within separate contracts, the competitive nature of the selection process, which may result in rates below actual costs, construction documents and budgets prepared without input from those who will ultimately construct the project, and the lack of flexibility to incorporate changes due to the linear design process followed by construction (Konchar, 1997; O'Connor, 2009; US DOT, 2006; AIA-AGC, 2011; AIA & AIA California Council, 2007). Moreover, as the processes are sequential in DBB, the total duration is accepted to be long.

Any of the above concerns raises the risk of poor production, time overruns, claims, change orders, and legal action. Although the extent of these issues' effects on the

initial project expenditure is unclear, they may result in a higher total project cost that exceeds the owner's budget (Carpenter, 2014).

Design-Build: DB is a project delivery system in which the owner establishes project specifications and contracts with a single firm to design and build the project. As a result, there is only one contracting phase to choose a single company to complete the project, as well as a single contract between the owner and this entity (Hale et al., 2009).

Although the DB system looks more integrated compared to DBB as the employer has a single contract with the DB company, several disadvantages of this approach are reported in the literature:

- If the design and build firm that the employer has appointed for the construction project is not sufficient for the requirements of the project, project implementation is negatively affected.
- Not knowing the exact cost of the project before the construction starts causes the employer to be unsafe in terms of cost.
- If the design and construction company is suitable for the construction phase rather than the design, then the project design quality issues may arise.

Construction Manager at Risk: While the DBB was primarily chosen for the construction projects for most of the 20th century, the CMR delivery method has been developed to meet the changes in the building industry such as the global competition and the demand for faster completion (Kent et al., 2010).

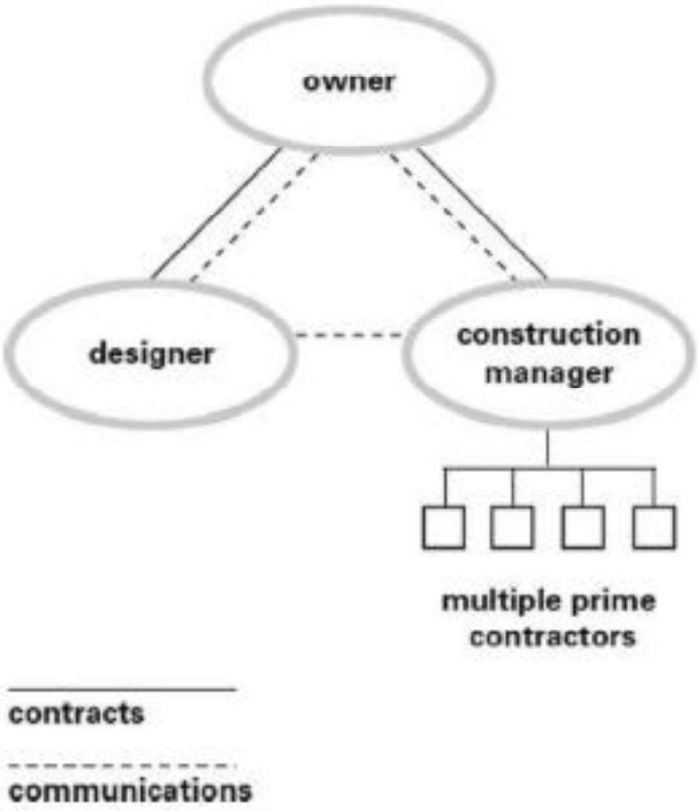

Figure 2.3 Construction manager at-risk agreements. (AIA, 2007)

Many owners believed that DBB was not providing them with the best value, so they converted to CMR in the 1970s, which combines the experience and resources of two different firms: an agent construction manager (CM) and a traditional general contractor (GC) (Bilbo et al., 2015). The owner has two separate contracts with two different firms, one with the CM and one with the designer, as shown in Figure 2.3. The CM in CMR is in charge of the work while also managing the trade contracts.

In the CMR model, the CM is determined prior to the completion of construction documents and is selected utilizing the best value procedure. After the CM is hired, CM becomes a member of the project team. The CM is paid for services such as planning, budget control, constructability, managerial skills, building technology, and bidding/negotiating construction contracts during the design process (AIA National, 2007). The CM is primarily responsible for trades management, daily site oversight, distribution of information to all project participants, and the provision of workers, supplies, and equipment during construction (Bilbo et al., 2015).

The contractual connections between project stakeholders and their time of engagement in the project are the most common criteria that characterize project delivery approaches (El Asmar et al. 2013; Sanvido and Konchar 1998). The relationships between important stakeholders for the two delivery methods outlined, DBB and CMR, are represented in Figure 2.4.

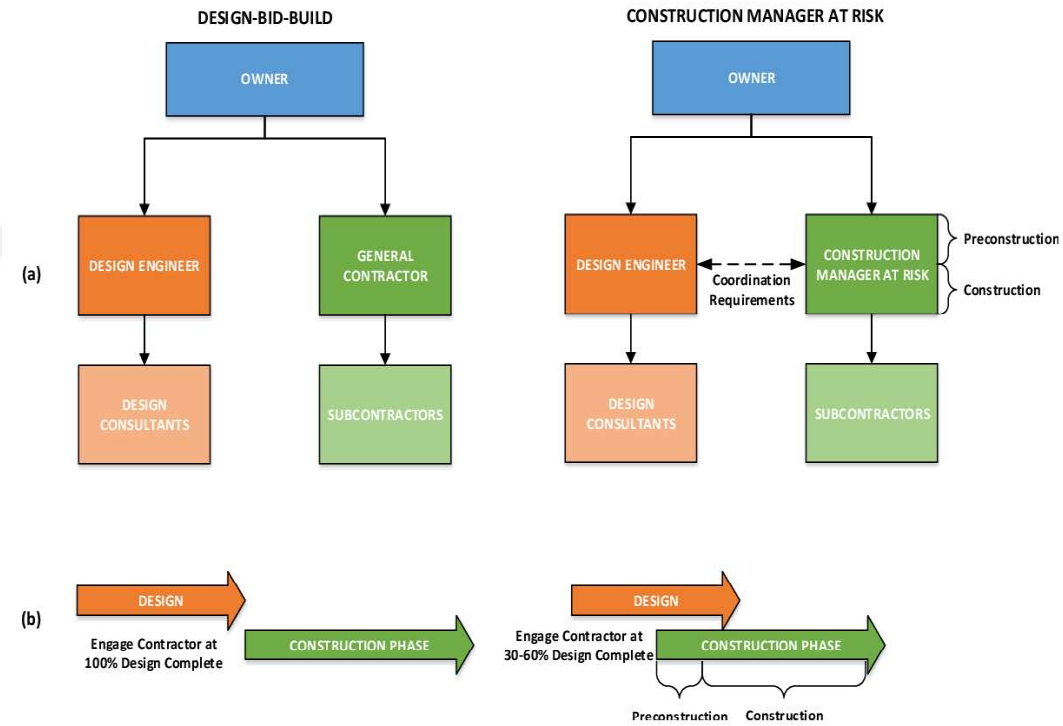

Figure 2.4 Engagement Timing and Relationships and Between Key Stakeholders in DBB and CMR (Francom, 2015)

Regarding the same aspect, Figure 2.5 is a general comparison of the project delivery methods in terms of timing of engagement and the contractual relationships. A single contract in DB allocates responsibility for both project design and construction to one entity through a single commitment (Molenaar et al., 1999; El Asmar et al., 2013). Similarly, with CMR projects, cooperation between the construction manager at risk and the design engineer starts during the design phase, but the design engineer and the construction manager each have their own contract with the project owner. Unlike the DBB technique, these methods involve the contractor considerably earlier in the project life cycle.

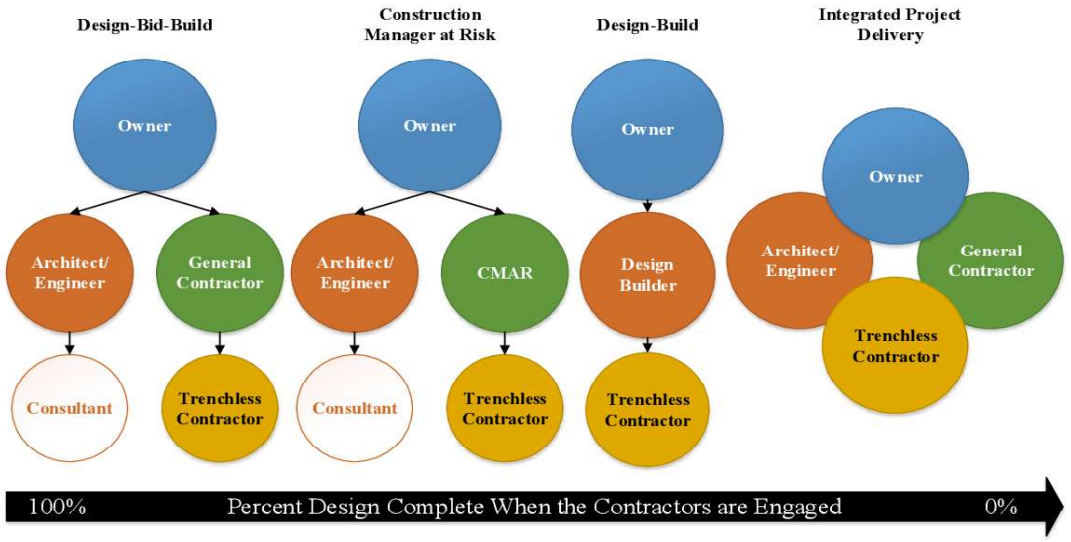

Figure 2.5 Typical Project Delivery Methods with Timing of Engagement and Contractual Relationships (Francom, 2015)

2.2 The Need For A Change

Studies show that the AEC industry is known to be a competitive but poorly innovative and unproductive industry, resulting in waste of resources, failure to meet customer expectations, and lower profits than expected. The conservative nature of traditional procurement methods is pointed out to be one of the most prominent causes of sectoral inefficiencies: Research and practical experiences suggest that poor outcomes in the AEC industry are caused mainly by the segregation of the process, actors, and the project delivery services.

Between 1964 and 2012, the construction industry's labor productivity declined by 19%, while it improved by over 153% in all other non-farm industries (WEF, 2016). According to a study by the U.S. National Institute of Standards and Technology (NIST), in 2004, $15.8 billion USD is lost each year (which is equal to 2.7% of the total value added by the construction industry in GDP), due to the inadequate collaborative working environment among CAD, engineering, and software systems. Around 40% to 50% of all building phases are taking longer than projected, implying that the projects would likely exceed their budgets (FMI & CMAA, 2005, p. 2).

In this respect, a number of studies have highlighted that an influential change in the way projects are designed, presented, and executed is needed (Ashcraft, 2014; CEC, 2015). However, AEC projects generate unique products in need of great collaborative work. Collaboration among project participants is hard to catch in AEC projects which are delivered by traditional systems due to conflicting interests of parties. While the owner's goals include better quality with lower costs and a shorter project schedule, contractors' and designers' primary aim is to increase their profits. It is impossible to fully share the information, know-how, and lessons learned with other parties in this complex environment.

According to the book entitled "Modern Construction-Lean Project Delivery and Integrated Practices" which was written by Forbes and Ahmed (2011), traditional contracts are adversarial in nature, with penalties for each party's underperformance or nonperformance on a project. Owner’s contract with a general contractor (GC) or construction manager (CM). As a result, these parties hire subcontractors for various construction works. Because contract wording encourages each subcontractor to focus entirely on completing their portion of the project on time and within budget, traditional commercial contracts provide no opportunity for subcontractors to collaborate or work together.

While the complexity of buildings increases year by year, poor collaboration among parties becomes increasingly problematic. As risks and losses caused by the above-mentioned issues got greater, similar questions showed up in minds of both clients and contractors: How to overcome problems caused by the poor collaborative environment? How to improve control over the cost, quality, and duration of projects?

To increase efficiency, the construction industry has begun to redefine stakeholders' routines in order to achieve integration (Harper et al., 2016; Abdirad & Dossick, 2019). The need for new project delivery methods is considered a matter of urgency (Zhang et al., 2018; Hamzeh et al., 2019). Closer integration and increased collaboration are also highlighted in studies to promote construction innovation (Blayse and Manley, 2004; Holmen et al., 2005; Rutten et al., 2009).

Matthews and Howell (2005) identified four systemic difficulties with traditional contracting in their research. These are summarized as follows.

- ‘Because the design lacks field input, good ideas are held back. While the general contractor normally brings in MEP contractors and other key trades once the drawings are in the design development stage to establish a competitive price, they frequently save their finest ideas in the hopes of getting a competitive advantage during the bidding process. Many of these suggestions are good. However, as the design team tries to include these late-arriving ideas, time and the opportunity for creativity are wasted.’
- ‘Contracting inhibits coordination as well as discourages cooperation and innovation. The traditional contract arrangement inhibits teamwork, discourages collaboration, and rewards some parties for improving their success at the expense of others.’
- ‘Inability to Coordinate. In traditional contracts, subcontractors have a legal responsibility to the general contractor or construction manager but no direct liability to the other subcontractors. As a result, they proceed according to the master schedule without focusing on each other's schedules. In some scenarios, the GC/CM is unconcerned about the subcontractors' precise preparation, resulting in several unpredictable events as field conditions change.’
- ‘The Subcontractors' Mantra Is Self-Preservation: Each subcontractor fights to maximize his performance because no one else will take care of him. Subcontractors defend their turf at the expense of the client and other subcontractors due to the subcontract agreement and inability to coordinate. Because the subcontract defines right and wrong, they frequently adopt a very legalistic and litigious approach, turning into such an army where the rules of war are *Every man for himself*.’

Relational contracting can address the issues highlighted by Matthews and Howell (2005) since it encourages parties to collaborate for mutual benefit and knowledge acquisition. It allows them to reduce risk rather than delegate it to others, and it allows them to achieve a successful conclusion that isn't only based on their own

self-interest. This outcome benefits all involved parties, particularly the client, and removes the need for stressed individuals to increase their reward by sacrificing quality and cost. Team-based incentives or reward mechanisms, collaborative behavior in meetings and reviews, and project team goals are all examples of successful relational models that place a premium on successful project outcomes (Forbes & Ahmed, 2011).

2004 and 2007 reports of the Construction Users Roundtable (CURT) clearly pointed out the need for more collaboration in general and in particular for IPD. In the earlier report, owners were encouraged to drive the construction industry change "by leading the creation of collaborative, cross-functional teams comprised of design, construction, and facility management professionals" (CURT, 2004). The second report in 2007 worded explicitly out CURT's path toward entering into IPD projects (El Asmar et al., 2013).

Several sources indicate that using IPD can provide significant benefits. The United Kingdom's Office of Government Commerce (UKOGC) forecasts construction cost savings of 2–10 percent for single projects and up to 30 percent for strategic partnering, in which integrated teams collaborate on multiple projects (UKOGC, 2007). A handful of effective IPD case studies are highlighted in reports by the American Institute of Architects (e.g., AIA 2010). In Mossman et al. (2010)'s study, case studies were used to discuss the possible benefits of integrated delivery. Clients benefit from increased value and lower energy costs of usage, designers benefit from reduced design documentation time and can stay under budget, and constructors benefit from less rework and more buildable facilities. (El Asmar et al., 2013).

Although project management is as old as time, it has been challenging to increase efficiency in building projects. Most of this arises from the adversarial partnership between the owners, designers, and constructors. Integrated project delivery is expected to overcome these obstacles by developing a collaborative environment that combines individuals, operating processes, corporate practices, and organizational structures.

2.3 Integrated Project Delivery

2.3.1 Introduction

IPD is a method for planning construction projects, reducing waste, lowering costs, and improving efficiency. The main goal of IPD is to create teamwork that integrates the owner, engineers, architects, consultants, and subcontractors. Unlike traditional ways of delivery, IPD creates a unique link from the planning stages to all important project stakeholders. IPD is generally acknowledged for facilitating stakeholder sharing of rewards and risks, creating incentives for outstanding performance, lowering completed project operations and maintenance costs, improving project delivery deadlines, and reducing waste through improved planning of shared-costs (DeBernard, 2008).

The American Institute of Architects (AIA) defines IPD as "a project delivery approach that integrates people, systems, business structures, and practices into a process that collaboratively harnesses the talents and insights of all project participants to optimize project results, increase value to the owner, reduce waste, and maximize efficiency through all phases of design, fabrication, and construction" (AIA, 2007).

Although this is the most common definition among all, it doesn't give detailed information about the principles of IPD. For a better understanding of the IPD concept, it would be better to look at how the authors of previous studies defined IPD. Table 2.1 provides an overview of IPD definitions provided by various institutions and researchers.

Table 2.1 IPD definition by literature from the year 2007 to 2015

(Rahim et al., 2015)

Scholar, Institution	**Year**	**Definitions**
AIA California Council	2007	'IPD as a project delivery approach that integrates people, organizations, business structures, and exercises into a process that collaboratively harnesses the talents and insights of all project participants to optimize the results, increase value to the owner, reduce waste, and maximize efficiency through all stages of design, manufacturing, and building'
Anderson	2010	'IPD as a business model for design, execution, and delivery of buildings by collaborative, integrated and productive teams composed of key project participants such as designer, client, contractor, manufacturer, and supplier'
El Asmar et al	2013	'IPD as an emerging construction project delivery system that collaboratively involves key participants very early in the project timeline, often before the design is started'
AIA California Council	2014	'IPD as a collaborative project delivery approach that utilizes the talents and insights of all project participants through all phases of design and construction'
Rahim S. A.	2015	'IPD as a method that requires the early involvement of key participants in an engaging, collaborative, and mutually dependent relationship throughout the entire project delivery phase from design to completion'

2.3.2 Background

Since the 1940s, DBB has been mostly adopted by the United States' (US) public procurement policies. While buildings were getting more complex, the construction industry needed to be specialized and it was understood that the responsibility of building delivery had to be allocated to many different parties instead of charging it solely to a master constructor. As a result of this attitude, multiple cultures within the industry came into view with inefficiency, high degrees of fragmentation (Department of Commerce, 2004), and high costs based on lack of collaboration (Gallaher et al. 2004). Against these problems, Construction Management (CM) occurred in the 1960s. It provided value to owners, but the underlying problems of fragmentation were still there. After DB was introduced in the 1990s, a study found that DB could reduce the cost, timeline, and could improve quality of construction projects as compared to traditional delivery methods (Konchar and Sanvido,1998). While DB was growing in the US, project alliancing was being successfully used as a new project delivery method in Australia. In contrast to the traditional risk-transfer approach, project alliancing aimed to improve project outcomes with shared incentives and goals of the project team. This was also a model for a new project delivery method that recently occurred in the US called IPD. Various relational project delivery approaches have been developed to overcome the problems caused by the industry's fragmented environment. IPD is the one that emerged in North America. The first usage of IPD for project delivery can be dated back to 2005 in the construction of healthcare facilities and hospitals in the US. In fact, the Sutter Health project, which began in 2005, is frequently credited with bringing in the IPD era (Cohen 2010; Lahdenpera 2012). According to the study by Yee (2017), IPD was introduced by the AIA in 2007.

2.3.3 Comparison With Traditional Methods

The first difference of IPD from traditional methods regards the collaboration among parties. In traditional methods, collaboration can only be mentioned after the design phase, when the construction starts. Firms and individuals are usually involved in the project at different stages, mostly when needed. In 2004, Patrick MacLeamy proved how this consecutive involvement in the project affects the process by drawing

curves that showed how a project becomes more challenging due to changes in later stages of development (Figure 2.6).

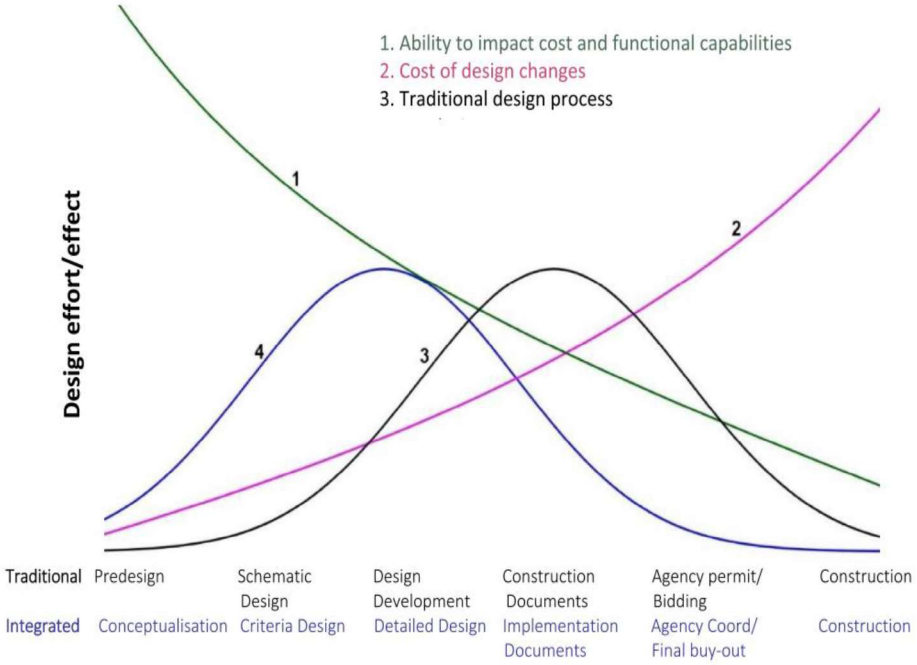

Figure 2.6 The McLeamy Curve

IPD, on the other hand, provides for more collaboration among key parties during the design phase. In this way, the design goals and outcomes can be thoroughly studied and understood by all participants.

Secondly, IPD differs from the traditional systems in terms of its approach to contracting. In the traditional method, the owner has separate contracts with each party, such as the designer, the contractor, the consultants, etc. In IPD, however, the owner and other key actors such as architects, general contractors, trade partners, and consultants are all bound by a single contract (Kent & Becerik-Gerber, 2010). In the present study, the contractual features of IPD are further examined through case studies, as previous literature has shown that IPD's contracting approach maximizes collaborative working.

Besides these two most significant differences, Table 2.2 summarizes how IPD differs from the traditional methods in terms of methods' characteristics.

Table 2.2 IPD comparison with traditional delivery methods

(AIA California Council, 2007)

Traditional Project Delivery	Characteristics	Integrated Project Delivery
Fragmented, assemble on "just as needed" or "minimum necessary" basis, strongly hierarchical, controlled	Teams	An integrated team entity, composed of key project stakeholders, assembled early in the process, open, collaborative
Linear, distinct, segregated; knowledge gather "just as needed" information hoarded; silos of knowledge and expertise	Process	Concurrent and multi level; early contributions of knowledge and expertise; information openly shared; stakeholders trust and respect
Individually managed, transferred to the greatest extent possible	Risk	Collectively managed, appropriately shared
Individually pursued; minimum effort for maximum return; (usually) first-cost based	Compensation/ Reward	Team success tied to project success; value-based
Paper-based, 2-dimensional; analog	Communications/ Technology	Digitally based, virtual; Building Information Modeling (3, 4, and 5 dimensional)
Encourage unilateral effort; allocate and transfer risk; no sharing	Agreements	Encourage, foster, promote and support multi-lateral open sharing and collaboration; risk sharing

Time and cost overruns and poor quality have been the main reasons of disputes among project participants in the construction industry. This is because of the conflicts of interests of the different parties. In traditional contracts, responsibilities of each party are clearly defined and limited, and consequences of the failure are imposed on whom it concerns. One of the most significant risks for every stakeholder is that work will be completed without payment, resulting in the stakeholder operating at a loss (Nanda et al., 2016). As a defensive behavior, the priority of the parties is to protect their own interests rather than focusing on project goals. Typically, the other parties are not regarded "to be on the same boat," and the burden of the failure that may arise should be transferred to other parties. Lack of

trust among parties is widely accepted to be a key barrier to integrating a team. In this point of view, the integrated project team has been the center of attention due to the contentious and ambitious environment of the traditional construction industry because of eliminating all these conflicts and setting the team spirit.

2.3.4 Principles of IPD

For a successful application of the IPD method, specific principles are necessary (Fischer et al., 2017). The IPD principles have been discussed by a number of professional organizations and researchers, which have been documented in a variety of white papers, guidelines, and journals. The principles discussed in this section are extracted from the outcomes of previous studies during the literature review. While Table 2.5 summarizes the studies reviewed to be a reference for this thesis with their main research topics, Table 2.3 shows which principles are mentioned in which paper that was reviewed.

Table 2.3 IPD principles with references

	Mutual Respect And Trust	Shared Risk and Reward	Mutual Benefit And Reward	Collaborative innovation & decision making	Early involvement of key participants	Early goal definition	Intensified planning and design	Open communication	Appropriate technology	Organization and leadership	Multiparty agreement	Liability waivers among key participants
AIA California Council,2007	X		X	X	X	X	X	X	X	X		
Becerik-Gerber, Kent, & DDes. , 2009			X		X						X	
Becerik-Gerber & Kent, 2010			X		X						X	
The Associated General Contractors of America, 2010	X		X	X	X		X	X				
Cohen, 2010		X		X	X	X					X	X
Amirarjmandi, Eghtedari, & Mazaheri, 2011	X		X		X					X		
Ghassemi & Becerik-Gerber, 2011	X			X	X	X					X	
Munakami, 2012	X		X	X	X	X	X	X	X	X		
Mihic, Sertic, & Zavrski, 2014	X		X	X	X	X		X	X			

Yee et al. (2017) recategorized elements of four principles which various researchers determined in Table 2.4. The principles relating to contractual terms that will be carried out in IPD projects are known as contractual or legal principles (KPMG,

2013). These principles are legally valid, and project parties should follow and apply them.

Behavioral principles refer to the informal relationships and programs that aim to improve team integration performance by addressing participants' mindsets and attitudes (Kiani and Ghomi, 2013). Communication, interpersonal, and negotiating skills are all critical behaviors that impact team members' efficiency and success. Project teams must implement these IPD principle elements for IPD to be effective in real-life situations (Yee et al., 2017).

When building an IPD project team as a whole, the structural concept is developed to show the organization of project team members and their relationships. Essentially, structural principles can evolve over time and accommodate lessons learned at different stages of a project (El Asmar et al., 2013).

The technological principles refer to the use of Information-Communication-Technology (ICT) as an interface tool to improve the collaboration level of the project team. According to AIA (2007), in order to support the integration and collaboration of multiple entities in IPD projects, sufficient technology is required.

Table 2.4 Recategorized principles of IPD (Yee et al., 2017)

Principles	**Elements**
Contractual / Legal Principles	Multi-party contract agreement
	Early involvement of key participants
	Shared financial risk and reward / mutual benefits
	Jointly developed and validated project goals and objectives
	Liabilty Waivers among Key Participants
	Fiscal Transparency (open book)
	Intensified Early Planning
Behavioral Principles	Mutual respect and trust
	Willing to collaborate
	Open communication
	No blame culture
	Organisation and leadership
	Unrestricted shared information
Structural Principles	Lean principle of design / construction / operation
	Co-location of team
	Team flexibilty
	Operate without boundaries
	Collaborative innovation
	Collaborative decision-making and control
Technological Principles	Appropriate technology
	Building Information Modeling (BIM) used by multiparty

Table 2.5 IPD Literature Reviewed

IPD topics in literature	References
Benefits of IPD	Viana et al. (2020); Piroozfar et al. (2019); Fish (2011); Kent&Becerik-Gerber (2010); Rahim et al. (2016); El Asmar et al. (2013); Marco&Karzouna (2018); Matthews&Howell (2005)
Principles of IPD	Viana et al. (2020); Dilsizoğlu-Özperçin (2016); Fish (2011); Rahim et al. (2016); Bilge (2018); Yee et al. (2017)
Potential Barriers and Obstacles of IPD	Viana et al. (2020) ; Durdyev et al. (2019); Abadi (2015); Fish (2011); Kent&Becerik-Gerber (2010); Marco&Karzouna (2018); Ghassemi&Becerik-Gerber (2011); Roy et al. (2018); Ebrahimi&Dowlatabadi (2019); Kahvandi et al. (2019)
Comparison of project delivery systems	Abadi (2015); Franz et al. (2016); Rahim et al. (2016); El Asmar et al. (2013); Ghassemi&Becerik-Gerber (2011); Lahdenpera (2012)
Collaboration & Team Integration	Viana et al. (2020); Franz et al. (2016); Pishdad-Bozorgi&Beliveau (2016); Pishdad-Bozorgi (2017); Ma et al. (2018)
Expert Opinions	Franz et al. (2016); Osman et al. (2017); Marco&Karzouna (2018); Ghassemi&Becerik-Gerber (2011); Roy et al. (2018); Ebrahimi&Dowlatabadi (2019)
BIM use in IPD	Viana et al. (2020); Dilsizoğlu-Özperçin (2016); Abadi (2015); Kent&Becerik-Gerber (2010); Bilge (2018); Elghaish et al. (2019); Ma et al. (2018)
Contractual Aspect of IPD	Viana et al. (2020); Fish (2011); O'Connor (2009); Bilge (2018); Marco&Karzouna (2018); Lahdenpera (2012); Matthews&Howell (2005); Pishdad-Bozorgi&Beliveau (2016)
Perspectives of specified regions	Piroozfar et al. (2019) ; Durdyev et al. (2019) ; Abadi (2015); Rahim et al. (2016); Bilge (2018); Gomez et al. (2018); Roy et al. (2018); Ebrahimi&Dowlatabadi (2019)

Since various organizations address IPD in different ways and have different degrees of detail, there is no accepted definition of IPD (Azhar et al., 2014). However, most IPD projects and concepts share consistent similarities. Basically, '*an integrated team sets project goals together, makes decisions by consensus, and shares risks and rewards associated with achieving them'*. In Cohen's report (Cohen, 2010), '*early involvement of key participants (EIKP); shared risk and reward (SRR); multiparty contract (MPC); collaborative decision making and control (CDMC); liability waivers among key participants (LWKP); and jointly developed and validated*

project goals (JDVG)' are defined as the key principles of IPD. Table 2.6 below provides brief descriptions of these attributes.

Table 2.6 Key IPD Principles (Azhar et al., 2014)

Characteristics	Description
EIKP	Involving the team including designer, constructor and trade contractors' right from the beginning of the project to help the owners to crystallize the project's goals and objectives from very early on and collaborate throughout the project.
SRR	Participating team members mutually shares the benefit of achieving project targets and simultaneously bears the risk of missing the targeted cost (schedule and quality).
MPC	The parties sign a single integrated agreement that clearly sets defines the role and responsibilities of all team members.
CDMC	The parties need to agree upon a clear and specific set of criteria for decision-making and control of project, which can be established according to the owner's goal for the project.
LWKP	Contracted parties waive any claim amongst themselves except for in the instance of a willful default to reinforce the sense of unity and a collaborative environment.
JDVG	Owner, with the help of the project team clearly defines achievable goals and benchmarks for measuring them. Risk and rewards are associated with achieving the set targets.

Much of the shortcomings of widely used project delivery methods can be overcome by incorporating these core characteristics into an IPD project. EIKP provides quality for projects. The administrative burden is significantly reduced by using a single contract. Coordination and collaboration are not only a work culture but also a must for IPD projects. Thereby, in brief, IPD is a business change that brings all project partners together and aligns their interests in order to complete a successful project. It necessarily involves owner leadership and complete buy-in from all main stakeholders. It also necessitates a mindset change away from traditional practises, which is in line with the IPD structure mentioned above. It is built on the foundations of trust and a willingness to work together.

The MacLeamy Curve (Figure 2.6) highlights the advantages of IPD's key principles. Late-stage design changes have a higher financial impact on project costs. Because IPD projects are more complex and require more disciplines to be included and integrated in order to generate more comprehensive design solutions, the time spent on design is longer than in standard contracting (Piroozfar et al., 2019).

In the construction industry, the term 'integration' is widely used to describe the concept of freely exchanging information among various stakeholders involved in the construction process (Vincent and Kirkpatrick, 1995). According to Howell (1996) and Jaafari and Manivong (1999), '*integration is the merging of disparate*

disciplines with widely differing goals, needs, and cultures into a cohesive and mutually supportive unit encouraged to complete a single task'. This leads to knowledge sharing and teamwork to attain a common goal.

Individuals from various parties with varying levels of expertise and knowledge comprise the integrated project team (Bröchner and Badenfelt, 2011). Because of the temporary and unique nature of construction projects, they frequently have little prior experience working with one another (Kent and Gerber, 2010). The integrated team's first principle is to trust others bonded with relational contracts, motivated by moral and social factors, and under the project management team. In the study by Zhang et al. (2014), the importance of team flexibility is shown to be an essential factor in meeting the needs of increasingly complex construction projects. The team has to respond to the changes effectively and fast.

Various studies and reports highlight the importance of team integration. Profound knowledge of integration can promote the building of integrated teams and facilitate parties in overcoming the psychological barriers of transition to IPD. Many studies have tried to fill the gap about the team integration concept. Adopting the conceptualization of an integrated team in construction, Baiden and Price (2011) describe integration as the "merging of different disciplines or organizations into a single cohesive and mutually supporting unit, with the alignment of processes and cultures." This leads to working together to achieve a shared goal through knowledge sharing. An integrated team comprises the client and others who are instrumental and active in the delivery phase providing solutions that meet the customers' requirements. The team needs the members to maximize the capacity of the delivery efficiency processes (Baiden et al., 2003).

Basically, IPD incorporates all project participants into one team, contrary to traditional contracting approaches. *'The integrated project team is the core of IPD that aims at collaborating people, systems, business structures, and practices into a process to harness the talents and insights of all participants to reduce waste and optimize efficiency through all phases of the project'* (AIA, 2007). Figure 2.7 shows how a legal agreement mandates the collaborative behavior of the team.

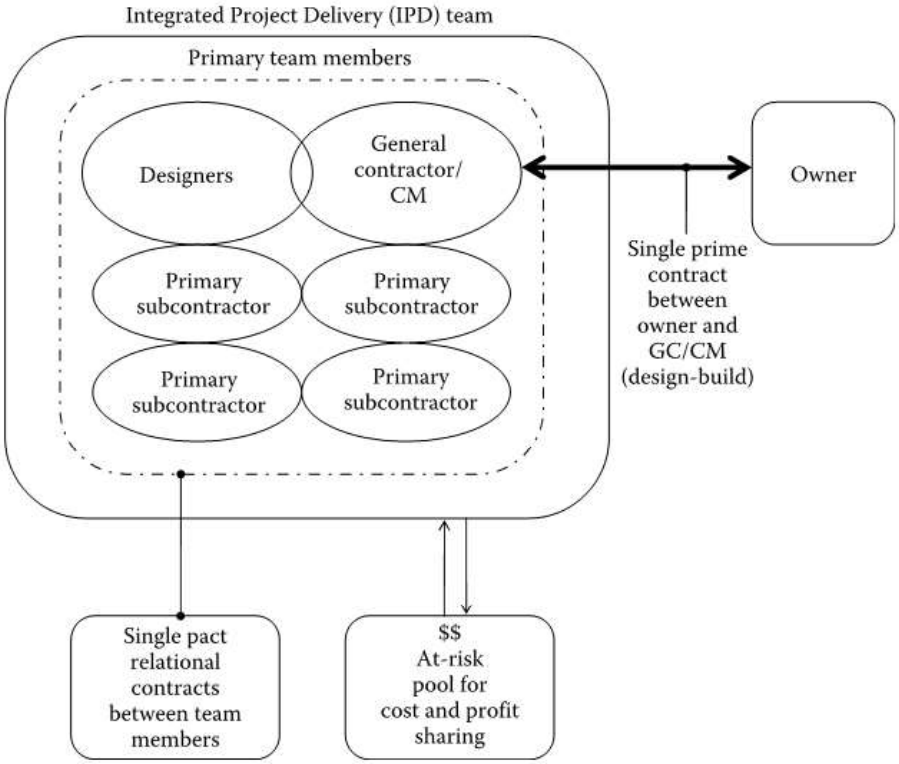

Figure 2.7 A representation of Integrated Project Delivery (Forbes and Ahmed, 2011)

On projects, trust is accepted as a cornerstone of developing a relationship culture (Kumaraswamy et al., 2005). Each project delivery method has a particular impact on team collaboration, trust, and project success. Pishdad-Bozorgi and Beliveau (2016) suggest that IPD is more effective than traditional delivery approaches at encouraging trust and collaborative work. They came to the conclusion that IPD and trust are mutually beneficial: while trust is a cornerstone of IPD, IPD also enables the generation of higher levels of trust (Pishdad-Bozorgi, 2017)

Chinowsky et al. (2010) examined the project organizations as social networks. High-performance teams produce outcomes beyond project goals and show special or creative strategies within a final solution. The source of the high performance is the desire to concentrate on the team's progress over individual goals. The social network model asks organizations to rethink the classical focus on communication as the catalyst of project progress, addressing the need to improve the free and open flow of information as the basis for achieving high results. The findings of the study by Chinowsky et al. (2010) proved that the need to emphasize social relationships as

equivalent to project communications is at the core of the construction model for social networks.

When a common culture is formed by setting aside the varied aims of parent organizations, it is widely considered that teams have a higher dedication and collective comprehension of project goals.

IPD is based on this approach. Team members are not limited to individuals; members can be companies that have their own separate teams. They still have their own interests to observe. They can have different working cultures. They can be working in different districts. Considering all of these, an important matter of concern is how to set trust among key participants of an IPD project. Is it about just contracting proficiency? If so, what are the key items to bound the team fully integrated with common goals and shared risks?

It is widely seen that firms or individuals who have worked together before prefer to come together to work as team members of an IPD project due to being a social network of project teams (Ashcraft, 2011). It shows that the trust needed for collaborative work for this approach is set easier between teams that know each other before as they already know each others' working cultures and problem-solving attitudes.

The degree to which communication patterns manifest and enhance team actions has been the subject of recent research into the usage of IPDs by integrated teams in the AEC industry (Aapaoja et al., 2013; Mesa et al., 2016; Franz et al., 2017). They also have begun to shed light on the effectiveness of particular communication behaviors and tools and their impact on multidisciplinary teams.

IPD promises to increase project efficiency and produce better outcomes, but the results will remain the same if the individuals in charge of delivering the results remain the same. As a result, in order to take full advantage of IPD, all project participants must adhere to the principles of integrated project delivery (Bilge, 2018). IPD's principals are influential in setting a solid team environment and collaborative establishment.

2.3.5 Advantages of IPD

Addressing the advantages and challenges of IPD practice is important to help professionals that do not have experience with IPD. As IPD is still struggling to gain traction in the industry and more research is needed to understand the value it can unlock, studies are being conducted to extract the benefits and challenges from practitioners' experiences. Table 2.7 summarizes the researches that focus on IPD practitioners' outcomes through surveys and interviews. These studies have shed light on the design of the interview questions that are asked to the professionals in the semi-structured interviews conducted in the scope of this thesis.

Table 2.7 Researches on practitioners' experiences

	Authors	**Year**
BENEFITS	Kent & Becerik Gerber	2010
	El Asmar et al.	2013
	Bilbo et al.	2015
	Nanda et al.	2017
	De Marco & Karzouna	2018

According to the researches listed in Table 2.7, which extracted the benefits of IPD based on the views of experienced practitioners, the majority of respondents indicated that they encountered superior performances in metrics related to quality, cost, and schedule (Kent et al., 2010b; El Asmar et al., 2013; Bilbo et al., 2015; Nanda et al., 2017; De Marco & Karzouna, 2018). Another benefit addressed by respondents was fewer change orders (Kent et al., 2010b; Bilbo et al., 2015; De Marco & Karzouna, 2018; Nanda et al., 2017). Additionally, fewer requests for information (RFI) was one of the benefits that were mostly remarked by professionals who have used IPD for their projects (Bilbo et al., 2015; El Asmar et al., 2013; Kent et al., 2010b).

Nanda et al. (2017) conducted interviews to perceive the benefits of IPD implementation and many stakeholders stated that the ability to work in large collaborative teams early in the process allowed them to understand the challenges

faced by other stakeholders and trade partners, and to learn how all project's components worked together. Building better relationships was another outcome that interviewees pointed out, which is known to be a very important factor for team selection in future IPD projects.

Apart from the common findings of the listed studies include better cost, quality, and schedule performances, some other benefits were addressed by the practitioners. Less stress and friction and more enjoyable projects were pointed out by the interviewees who took part in the research by Kent & Becerik-Gerber (2010). In a similar vein, the interviewees of the study by Bilbo et al. (2015) remarked that they encountered the benefits of collaborative problem solving and a higher level of productivity while using IPD.

Improved productivity, less construction administration, and use of more prefabricated materials were addressed by the professionals who took part in the research by Kent & Becerik-Gerber (2010) and De Marco & Karzouna (2018) as interviewees.

Korb et al. (2016) conducted a study to extract the key success factors and barriers from the practitioners of a first-time IPD use in traditional construction culture. The authors presented a detailed case study of the 'Saxum' project in Abu Ghosh, Israel, which was the country's first IPD implementation, interviewing the key participants of the project. IPD was chosen for the project with the guidance of the Owner's Representative (OR) who is a European engineer experienced with using transparent agreements before, but not IPD. Given that the traditional DBB technique remains the core of Israeli construction, when the OR contacted the Israeli construction industry with his wish to employ IPD, he was met with suspicion regarding the approach's relevance to the local culture and construction subculture. Despite the suspicions, IPD was used for the projects with satisfying outcomes. The quality of the product was very high, with a project cost that was below the target cost.

The project manager of Saxum Center remarked in an interview which was conducted for the study by Korb et al. (2016) as:

'This was a difficult project, and without the collaborative approach, I have no doubt that we would have ended up in court over some of the problems that came up. But

because we had the IPD framework, we managed to work things out internally, since everyone was committed to finishing the project, not just to their own personal financial interests.'

Despite various unexpected challenges, there have been no legal disputes between the parties in the Saxum project, which was the first time IPD was implemented in a country.

The Saxum Project gave an example to the construction industry in a country that has not experienced IPD yet to overcome the challenges and benefit from its use.

2.3.6 Barriers To IPD

Why is the number of projects using IPD very small despite being supported by several organizations, and its benefits are clearly seen regarding several project outcomes? Several reasons for slow adaptation can be listed, such as close partnership risks and the need for new legal frames to be compatible with IPD attitudes.

When it comes to delivering projects by IPD, the construction industry faces significant challenges (Teng et al., 2019). To date, only a few studies have focused on IPD barriers (Xie and Liu, 2017). As a result, a lack of knowledge of the obstacles which leads to a lack of motivation in applying IPD has a negative impact on project performance growth in developing countries (Rached et al., 2014). It's essential to recognize the challenges to tackle them (Kahvandi et al., 2019). Looking at previous literature, it has been observed that there is a clear consensus among researchers on the classification of the barriers. These barriers include 'cultural, financial, legal, and technological' factors (Kent and Becerik-Gerber, 2010; Lichtig, 2010; Cohen, 2010; Ghassemi, 2011). A well-implemented IPD also demands the participation, cooperation, and engagement of local governments and agencies, as well as a stable legislative and regulatory framework and the integration of developing technologies like BIM (Ghassemi and Becerik-Gerber, 2011; Kahvandi et al., 2017; Ma et al., 2017).

On the other hand, developing countries are poor to meet these expectations (Fernando et al., 2017; Hosseini et al., 2018), underlining the fact that barriers to IPD

adoption exist, particularly in developing countries (Rached et al., 2014; Hamzeh et al., 2019). IPD is becoming more widely used in the United States and other parts of the world, it has yet to be implemented in developing countries (Rached et al. 2014).

For a better understanding of barriers that will be faced in the transition to IPD in Turkey, findings of literature review about barriers in developing countries are also analyzed. Despite the numerous benefits of this new approach, there is currently no evidence of IPD implementation in Turkey. The lack of knowledge of the obstacles which leads to a lack of motivation in applying IPD has a negative impact on project performance growth in developing countries (Rached et al., 2014), especially where there is a lack of efficiency, high project costs, and time overruns in the industry (Ghoddousi and Hosseini, 2012; Durdyev et al., 2018; Durdyev and Hosseini, 2019).

Because IPD implementation is more common in developed countries, it has been easier to define the barriers to IPD in developed countries. As a result, studies from developed countries account for the majority of identified barriers in the literature (AIA, 2007; Atkinson and Westall, 2010; Kent and Becerik-Gerber, 2010). The findings of the studies that investigate the barriers in developed countries may shed light on the research about the difficulties that the developing countries will face in IPD implementation.

Barriers in developing countries

In the light of these defined barriers for developed countries, some of the potential barriers to IPD implementation in developing countries have been highlighted in the related literature. The outputs of this section will provide a brief description of its effective execution. What obstacles to IPD adoption have been discovered in recent years in different countries, especially in developing countries, and how can they be classified?

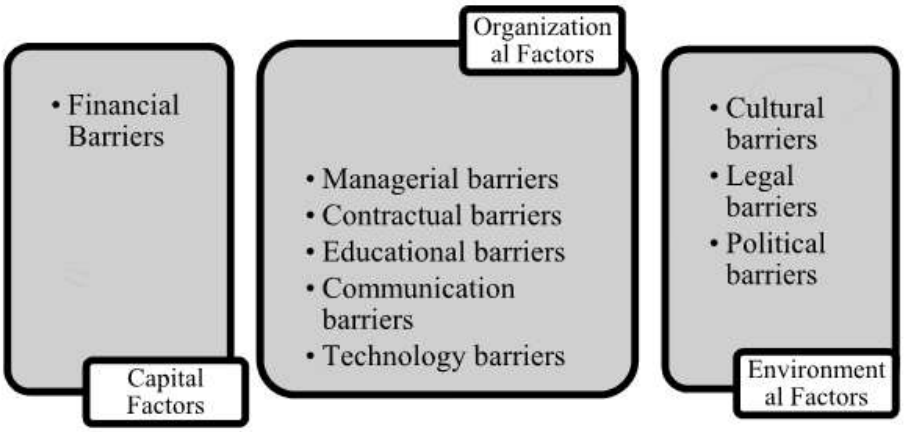

Figure 2.8 Classification of macro factors and barriers to IPD implementations (Kahvandi et al., 2019)

In their study, Kahvandi et al. (2019) divided the barriers into three main groups (Figure 2.8): capital, organizational and environmental factors. Related but not limited to this table, the literature review outcomes are gathered with a new classification by the author. Table 2.8 below gives a brief explanation of the classification of the barriers to IPD implementation in developing countries and in which study they were defined.

Table 2.8 Categorization of barriers to IPD in developing countries

Barrier Category	Explanation	Previous research
Cultural Barriers	Unwillingness to accept a new system	Ghassemi & Becerik-Gerber (2011)
		Rached & Hamzeh (2014)
		Kahvandi et al. (2019)
		Dargham et al. (2019)
		Korb et al. (2016)
	Mutual respect & trust	Roy et al. (2018)
		Kahvandi et al. (2019)
	Inexperienced with each other and IPD	Roy et al. (2018)
		Roy et al. (2017)
		Kahvandi et al. (2019)
	Competetive contract language	Roy et al. (2018)
		Roy et al. (2017)
	Awareness and willingness about IPD among owners.	Roy et al. (2018)
		Roy et al. (2017)
	Training & Skill enhancement	Ghassemi & Becerik-Gerber (2011)
	Tendency of slide bac into well-known behaviors	Korb et al. (2016)
	Zero-sum game thinking	Korb et al. (2016)
Legal Barriers	Insurance Issues	Ghassemi & Becerik-Gerber (2011)
		Kahvandi et al. (2019),
		Roy et al. (2017)
	Public Sector's tendency to select the lowest bidder	Rached & Hamzeh (2014),
		Roy et al. (2017)
	Need for new legal framework	Roy et al. (2018)
Financial Barriers	Selecting compensation for damages	Kahvandi et al. (2019),
		Rached & Hamzeh (2014),
		Ghassemi & Becerik-Gerber (2011)
	Equitable distribution of gain loss among stakeholders	Roy et al. (2017)
		Roy et al. (2018)
	Change in accounting scheme of key stakeholders	Roy et al. (2017)
		Roy et al. (2018)
	Accepting the risks associated with the return on investmen	Durdyev et al. (2019)
Organizational Barriers	Firms readiness to adopt IPD	Roy et al. (2017)
	Considering IPD as a risky buisness	Dargham et al. (2019)
	Using advanced tools of ICT	Azhar (2014)
	High prices of BIM apps	Kiani and Khalili Ghomi (2013)
	tegration of information and knowledge management syste	Roy et al. (2017)
		Roy et al. (2018)
	Inexperienced with reqired technology	Roy et al. (2017)
		Roy et al. (2018)
	Unclear BIM standards and practices	Roy et al. (2017)
		Roy et al. (2018)
	Lack of education	Kahvandi et al. (2019)

Cultural Barriers:

Ghassemi and Becerik-Gerber (2011) state that companies have been found to be resistant to accept a new system of implementation when discussing the cultural barriers to IPD adoption. The authors state that inertia or resistance to transition is the main cultural concern as many companies have become so used to their management structure that they would rather not change it either in developed and developing countries. Dargham et al. (2019) point out that the cultural inertia to change is a notable barrier for the Lebanese construction sector.

Cultural barriers are mentioned as the most pronounced limitation in the Middle East by Rached et al. (2014). Littrell and Bertsch (2012) discovered a important cultural

dimension: *'The Middle Eastern society finds it difficult to change its routines and does not readily accept the concept of change.'*

The Global Leadership and Organizational Behavior Effectiveness (GLOBE) research program evaluates cultural characteristics and culturally endorsed leadership ideas on ten culture clusters to establish a solid foundation for conceptualizing worldwide leadership disparities. The results concerning the Middle East cluster scored low in uncertainty avoidance, future orientation, team-oriented, and participative attributes, which are all essential for an IPD project's performance. Findings of the survey which was performed in the study by Rached and Hamzeh (2014), showed that to allow the implementation of IPD, teamwork, change, future orientation, trust and transparency must be progressively present among all project partners.

Roy et al. (2018) found that the majority of the challenges described in the literature fell under the category of cultural barriers when looking at India's aspect. The most critical among the 12 challenges identified in the study were; 'mutual respect and trust, inexperience with each other and IPD, contract language that carries the wounds of previous battles, and awareness and willingness about IPD among owners.'

Because of previous opportunistic behavior experiences, there is a lot of mistrust among the parties in the Indian construction industry. As a result, the parties have been accustomed to contract wording that is clogged with provisions aimed to prevent failures. Furthermore, unfamiliarity with each other's work culture and decision-making methods causes concern regarding early target establishing collaboration. Finally, the participants of the discussion held in the study by Rot et al. (2018) highlighted a lack of awareness and willingness among the owners about IPD. Although it is believed that for IPD to succeed, all stakeholders, from the owner to the subcontractor, should be excited about the model, it is ultimately the owner's decision to choose the type of project delivery model to be used.

The transition to IPD, like many other big changes, necessitates not only changing behavior but also changing individual and organizational mindsets (Barker, 1993). Implementing IPD requires AEC professionals to learn to see other project

participants as collaborators rather than competitors to be defeated – an example of a zero-sum approach (Emiliani, 2008) – but as colleagues with whom to collaborate in order to achieve mutual success for the project and for each of the participants. This is what is known as "non-zero-sum" thinking; in other words, each party's success does not have to come at the expense of another (Korb et al., 2016).

Another challenge defined by Korb et al. (2016) is the inherent propensity to revert to old habits, which is valid regardless of underlying regional cultures. Individual actors may be motivated to "defect" and try to exploit the collaboration for their own personal gain, despite the fact that, as game theory illustrates, collaboration has the potential to benefit all parties involved.

Legal Barriers:

Several challenges to IPD adoption have been listed as legal issues in the literature. IPD implementation has been found to be problematic due to country laws (Kahvandi et al., 2019). In particular, the public sector seems to be having problems in this respect, as competitive tendering procedures frequently favor selecting bidders with the lowest prices (Collins and Parrish, 2014). According to Rached and Hamzeh (2014), IPD's contractual approach is inhibited by the public procurement law in the public sector, which forces authorities to select the lowest bidder (in the Middle East region). Similar to the Middle East (M.E.), India's public construction sector also has the convention of choosing the lowest bidder. According to the study by Roy et al. (2017 and 2018), The Government of India, through its numerous ministries, regulatory bodies, and public sector undertakings, is the largest client for construction projects in India. Current tendering regulations are strict for all projects funded by public funds; the contract should be awarded to the lowest bidder. It is not in compliance with the current rules since the criteria for selecting agencies in IPD are supposed to be value-based rather than cost-based.

The governing delivery approach is the traditional DBB method in the M.E. region (Rached & Hamzeh, 2014). In terms of contracting procedures, the Fédération Internationale Des Ingénieurs-Conseils (FIDIC) family of contracts has been extensively used in the Middle East since the 1970s for traditional project delivery approaches. The most widely used FIDIC contract in the area is FIDIC Red, which

refers to the conventional design-bid-build delivery procedure (Webster, 2009). FIDIC contracts, on the other hand, seem to have certain disadvantages. When opposed to IPD's relational-type contracts, they are transactional and rigid (Matthews and Howell, 2011). Furthermore, traditional delivery systems do not have coordination mechanisms that improve teamwork (Wilkinson, 2012). For example, the contractor plays a minor role in the design and construction technique choices (Watson, 2001).

Financial Barriers:

Roy et al. (2018) identified two critical issues among the financial barriers; *'the equitable distribution of opportunities for gain and potential for loss among parties, and the difference in the accounting of costs and profit among the client, consulting, and contracting firms'*. Despite extensive research into models for sharing risks and rewards among stakeholders in an IPD, no widely agreed formula has emerged. This is particularly critical because the project's reward must depend on several factors, including cost, time, quality, and safety. The main concern here is that the customer, consultant, and contractor all have different risk appetites. Each stakeholder can tend to push their individual business risk to the mutual pool in order to maximize their share of the payout. A variety of well-researched risk-sharing formats are available, such as the AIA document C191 (2009) 'Target Criteria Amendment and Target Cost,' and Consensus300's Cost benchmarking, Price estimate, and Risk pool process (2007). However, for these established formats to be accepted, all parties must agree to share costs and benefits depending on their level of participation (Roy et al., 2018). The difference in cost and profit accounting practices among designers and contractors was the other financial barrier defined in the study by Roy et al. (2018). Profit is incorporated into designers' hourly costs, while it is calculated as a percentage of the total expense for contractors. As a result, combining these two methods of accounting procedures into a single form of expense and benefit estimation is a big obstacle.

The compensation system of IPD is based on the project alliancing model to encourage efficiency and align interests for the benefit of the project as a whole (ADTF, 2006). Choosing compensation for damages is a significant difficulty in implementing IPD (Becerik-Gerber & Ghassemi, 2011; Kahvandi et al., 2019).

Rached and Hamzeh (2014) also emphasized the difficulty of determining compensation and incentive systems that are appropriate for the project's and participants' unique characteristics. As a result, before signing the multiparty contract, a thorough investigation should be conducted to assess each party's risks in the project. This ensures that the shared savings and profits are distributed fairly. If the incentive program is not carefully planned, it might drastically lower the morale of the teams engaged, affecting their production (Rached & Hamzeh, 2014).

Lack of interest by stakeholders and key decision-makers in accepting the risks associated with the return on investment (ROI) is another main barrier of IPD that is addressed in the study by Durdyev et al. (2019). Usage of any innovative methodology is related to the stakeholders' perception about the expected ROI they receive (Slaughter, 1998; Hosseini et al., 2015). The study by Durdyev et al. (2019) pointed out that IPD is not considered as a ROI-guaranteed method in Malaysia.

Organizational Barriers:

According to Dargham et al. (2019), IPD is considered a risky business in the Lebanese context. In this concept, lack of knowledge concerning IPD agreement forms, lack of confidence and trust among teams, being not confident with IPD contracts when it comes to liability, risk/revenue sharing, and insurance are the main factors that inhibit the use of IPD.

Azhar et al. (2014) mentioned that the organizational barriers of IPD use are similar to those observed in using advanced tools of ICT in terms of the need for a high flow of data transmission. One of the most critical tools for IPD implementation is BIM. However, there are certain obstacles to its use in IPD, such as the lack of legal protection for organizations, the high prices of BIM apps, a lack of access to all stakeholders for software education, stakeholders' unfamiliarity with BIM, and subcontractors' lack of use of BIM (Kiani and Khalili Ghomi, 2013).

Roy et al. (2018) defined the technological issues that need to be resolved in India. Some of the most critical issues identified are integrating data, knowledge management frameworks, early definition of target objectives without fully developed design, and unclear BIM standards and practices. With the need for well-

established data and knowledge management frameworks in the AEC industry in India, collaborative decision-making becomes a challenge (Roy et al., 2018).

According to the study by Kahvandi et al. (2019), educational issues are defined within organizational barriers to IPD implementation because true understanding of the implementation of IPD will be helpful for all parties. Restrictions for adopting IPD exist in various parts of the world, such as the Middle East, for various reasons, including a lack of comprehensive research related to IPD.

Potential Barriers to IPD in Turkish Construction Industry

Defining the barriers in developing countries can shed a light on the challenges that the Turkish construction industry will probably face transitioning to IPD. This section will examine the potential barriers in regards to the classification given for developing countries. These are; organizational barriers, financial barriers, and legal barriers.

Organizational Barriers:

Performing IPD projects necessitates the use of collaboration platforms as shared information repositories. A collaborative modeling platform should be used to create BIM models collaborated by multiple disciplines and with minimum conflicts. BIM technology enables the production of a 3D building information model and the collaboration of various disciplines on this model. The data on the building information model covers a building's complete life cycle. A qualified BIM model consisting of sub-models (different parts of the building or other disciplines) is developed to achieve this objective. This type of work necessitates the formation of specialized teams that follow a linear workflow, with each part being created on top of the previous one (Chen and Tien, 2007). All project participants have to have the infrastructure to obtain full collaboration, which necessitates technological tools, continuous education, and support. Despite the benefits of BIM technology, it is not widely used in the Turkish construction industry compared to other countries (Tan, 2021) In the Turkish construction industrial environment; generally, just well-known AE companies have comprehensive tools, a fact which can potentially be one of the most critical operational barriers for IPD in Turkey.

BIM is one of the major tools but not a prerequisite for IPD. However, Abadi (2015) concluded that survey participants from Turkey believed that BIM was the main prerequisite for IPD.

As BIM is still one of the essential tools for IPD use, the lack of mandatory requirements for BIM use in Turkey is a substantial challenge to overcome. The use of BIM is supported in only rail system projects in the Country. According to Selim (2019), Istanbul Metropolitan Municipality is the only institution that obligates the use of BIM in railway projects. Furthermore, national codes do not exist: Although there are some forums and organizations to ensure the meeting of different disciplines involved in the construction sector in Turkey, there is no document or code issued by the government (Çileli, 2020). Additionally, as BIM is still at the beginner level in Turkey, there is also a need for qualified employees who are competent in using BIM. According to the survey by Tan (2021), there is not a sufficient number of well-trained employees in Turkey's construction industry. With the awareness of this need, BIM has started to be included in the educational content at universities. However, Tan (2021) remarked that the number of courses for BIM applications in the educational programs of the architecture and engineering departments of universities are not sufficient yet. The lack of sufficient number of sources about BIM in Turkish language is also pointed to be an important factor limiting BIM training in Turkey (Tan, 2021).

According to the study by Bahçeci and Polat (2020), survey findings showed that the contracting companies are distant to BIM use transition. Another disappointing result of the same survey was that contractors often perceived the BIM development process as a waste of time.

Tan (2021) explored the factors limiting the prevalent use of BIM technology in the Turkish construction industry. The most remarkable findings of her research are related to the low-level awareness and knowledge of BIM applications. Being unfamiliar with BIM applications' clash detection features, not knowing that alternative design options can be analyzed and most suitable project design can be selected with BIM use, not being aware that design, program and budget information are available with BIM at the design stage are the reasons of being distant to BIM transition regarding lack of awareness.

Legal Barriers:

Legal barriers that are potential to IPD use are related to the public procurement laws in Turkey. The selection of the contractor and subcontractors is an issue that matters regarding the relationships between the employer and recipient firms being one of the success criteria. In Turkey, The lowest bidding price is used to choose the contractor, which can lead to cost overruns, conflicts, and poor quality (Ozkaya and Gelisen, 2019). Since 2002, Turkey has used the Public Tender Law (PTL) to tend public projects (Kazaz et al., 2012). According to PTL, open tendering, tendering among specific bidders, and bargaining (PTL, 2008).

Kazaz et al. (2012) explored the use of IPD for public construction projects in Turkey in terms of tendering regulations. Table 2.9 which is obtained from the conference paper of Kazaz et al. (2012), provides valuable information on the applicability of the IPD principles to tendering methods regarding PTL.

Table 2.9 Comparison of tendering methods (Kazaz et al., 2012)

	OPEN TENDERING	TENDERING AMONG SPECIFIC BIDDERS	BARGAINING
Early Integration of Key Participants	-	+	+
Shared risk and rewards	-	+	+
Relational Contracting	-	+	+

According to Kazaz et al. (2012), it is possible to adopt IPD in public projects by dividing the construction projects into two groups of activities: application-based activities and management-based activities. Application-based activities can be listed as material procurement, formwork erecting, reinforcement fixing, concrete poring, excavation works, etc. Activities based on project management are design, planning, coordination, controlling, etc. In this manner, although the IPD application is challenging to open tendering method, it can be partially resolved by utilizing some PTL clauses.

Clause 12 in PTL says:

'Although administrative and technical specifications that explain project characteristics shall be prepared by the related public institution, they can be prepared by means of outsourcing if necessary.' (PTL, 2008).

As previously noted, project activities should be divided, and the outcomes of management-based activities should be included into technical requirements. This step may pave the way for IPD implementation in public construction projects.

Implementation Regulation for Tenders of Construction Works (Yapım İşleri İhaleleri Uygulama Yönetmeliği, 2009) obligates to prepare the contract based on the standard contract document given as an appendix to related regulation, in Section 18-1.

The Law 4735, on Public Procurement Contracts (Kamu İhale Sözleşmeleri Kanunu, 2003) establishes the principles and procedures for preparing and implementing public procurement contracts under Public Procurement Law 4734 (Kamu İhale Kanunu,2002). Contract types to be used in public projects are defined in article 6 of the regarding law. Widely used project delivery systems by the public employers in Turkey are DBB and DB related to Law 4735 (Ozkaya and Gelisen, 2019). As far as the opportunities for IPD use is concerned, it can be stated that DB is easy to change to IPD as the designer and the contractor is appointed at the same early stage of a project, which is compatible with the main principles of IPD (Abadi, 2015). However, as mentioned in the study by Cakmak (2014), KİK (Kamu İhale Kurumu-Public Procurement Authority) forces the use of the standard contract documents (Yapım İşlerine Ait Tip Sözleşme-Typical Contract for Construction Works-KİK 2013a, Article 18) for public projects. This typical contact is suitable only for an agreement between the owner and contractor. On the other hand, there is no other standard document generated and submitted by an institution to use for the public or private sector projects, but the standard FIDIC contracts which are translated in Turkish by the Association of Turkish Consulting Engineers and Architects (Türk Müşavir Mühendisler ve Mimarlar Birliği-TMMMB) (Cakmak,2014). This is the main obstacle to solve in the legal frame for Turkey. Thus, a new legal framework for the use of relational contract type is needed for IPD adoption in the Country.

Table 2.10 shows the typical contract articles, which is given as an appendix to Law 4734 Public Procurement Law (KİK,2013b). To see the articles of the typical contract for the public project will give a chance for easy comparison with the IPD contract articles shown in Table 2.11.

Table 2.10 Table of articles of Law 4734 Public Procurement Law (KİK,2013b)

Article 1	Contracting Parties
Article 2	Information Regarding the Parties
Article 3	Job name, location, Property, Type and Quantity
Article 4	Contract Language
Article 5	Definitions
Article 6	Contract Type and Cost
Article 7	Expenditures included in contract cost
Article 8	Appendix
Article 9	Beginning Time-End Time
Article 10	Payment Location and conditions
Article 11	Assurance conditions
Article 12	Work Schedule
Article 13	Advance payment and conditions
Article 14	Extra over price payments and calculations
Article 15	Subcontractors
Article 16	Conditions of support services such as assembly, training, maintenance, spare parts, etc.
Article 17	Insurance on job and location
Article 18	Acceptable circumstances to time overruns
Article 19	Conditions on acceptance and control
Article 20	Warranty Period
Article 21	Conditions on construction inspection and responsibilities
Article 22	Responsibilities of contractor and subcontractors

Article 23	Providing of technical personnel, machines, equipment
Article 24	Modification on the contract
Article 25	Charges for delays and contract termination
Article 26	Contract termination conditions
Article 27	Extra works in scope of contract, reductions, and liquidation
Article 28	Unit price determination of external works
Article 29	Contractor responsibilities on personnel
Article 30	Provisional acceptance punch list
Article 31	Dispute Resolution
Article 32	Legal Clauses
Article 33	Miscellaneous
Article 34	Operation
Article 35	Signing of the contract

The first and second article of the typical contact given in the Public Procurement Law includes information about the contract parties. As it is shown in Figure 2.9, it is not suitable for collaborative work as it is underwritten only between the owner and the contractor. It doesn't give any explanation on design works.

TYPICAL CONTRACT FOR CONSTRUCTION WORKS

Article 1 – Contract Parties [1]

1.1. This contract is concluded between ..... (will be mentioned as Owner) and ..... (will be mentioned as Contractor) with below-written conditions.

Article 2 – Information Regarding Parties

2.1. Owner

a) Name: .....

b) Address: .....

c) Phone number: .....

ç) Fax number: .....

d) E-mail [2]: .....

2.2. Contractor

a) Name, Family name/Trade name[3]: .....

b) Identity Number[4]: .....

c) Taxpayer Identification Number[5]: .....

ç) Address[6]: .....

d) Phone Number: .....

e) Fax Number: .....

f) E-mail : .....

Figure 2.9 Articles including the contract parties-Typical Contract in Public Procurement Law-Appendix 7

The ConsensusDocs documents are a set of standard contracts developed by a consortium of organizations that represent contractors and other construction industry stakeholders, which has Over 110 Standardized Construction Contracts Agreement documents that incorporate fair risk allocation and best practices to define the project's best interests. In contrast with the typical contact, ConcensusDOCS 300 have the key participants of IPD to lead a relational contract. Figure 2.10 shows Article 1 that includes the contract parties. Table 2.11 shows the articles of the collaborative form of ConsencusDOCS.

Table 2.11 Table of Articles of ConsensusDOCS 300 multiparty agreement

Article 1	Agreement
Article 2	Definitions
Article 3	Collaborative Principles
Article 4	Management by the management group
Article 5	Owner provided information
Article 6	Development of design and collaborative preconstruction services
Article 7	Project planning and schedule
Article 8	Project budget, cost modeling and project target cost estimate
Article 9	Designer's compensation
Article 10	Constructor's compensation
Article 11	Incentives and risk sharing
Article 12	Trade contractors and subcontractors
Article 13	Construction operations
Article 14	Designer's construction phase services
Article 15	Time
Article 16	Designer's compensation and payment
Article 17	Cost of work
Article 18	Payment
Article 19	Right to audit
Article 20	Changes
Article 21	Indemnity, insurance and bonds
Article 22	Suspension, notice to cure and termination of the agreement
Article 23	Dispute resolution
Article 24	Miscellaneous
Article 25	Contract documents

ARTICLE 1
AGREEMENT

This Agreement is made this_____day of_____ in the year_____by and between

The OWNER *(Name and Address)*

and the DESIGNER *(Name and Address)*

and the CONSTRUCTOR *(Name and Address)*

for the following PROJECT *(Address and Brief Project Description)*

Figure 2.10 ConcensusDOCS 300 Article 1

Although IPD in the public sector is hindered by PTL and substantial revisions are needed on laws, no obstacles have been observed in using relational contracting for private construction projects.

Document A295 by AIA gives general conditions of the contract for IPD. Cileli (2020) explored the design processes of the BIM-based construction projects in Turkey related to IPD and the author has conducted a questionnaire in terms of the A295 document between the professionals of the Turkish construction industry. Cileli concluded that even the three of the fifty-one actions to be taken are run with a performance of under 50% and it has been observed that the contractors do not undertake major roles. No action is observed in terms of schematic design, developed design, and technical design stages that are run by the owner, designer, and contractor working collaboratively. These findings show that the Turkish construction industry is not familiar to work under IPD principles.

Another barrier in the legal framework is the process periods in Turkish public offices. According to the study by Bayramoglu (2000), Turkish government departments are notorious for their time-consuming bureaucratic processes, which include massive quantities of paperwork, lengthy wait times, and many redundant

formalities. The negative consequences of such bureaucracy have a significant impact on construction projects and the construction processes. Applications for construction-related permits go through a hierarchical process that can take months to complete. This leads to rework, poor quality results, time, and cost overruns. In the case of IPD, all the participants are affected by this long-term bureaucratic process because they are involved in the projects starting from the earliest stages.

The surveys results of the study by Tan (2021) showed some legal barriers related to BIM use. Since BIM is seen as a requisite to IPD use, these barriers can also provide a viewpoint for the legal challenges of IPD transition. Lack of governmental support to BIM use and lack of regulation that makes BIM use a mandatory were found to be inhibitors to BIM use becoming widespread.

Financial Barriers:

As BIM use is one of the most important tools to IPD, the lack of mandatory requirements for BIM use in Turkey is a substantial challenge to overcome. This barrier can be classified both in organizational and financial barriers as the initial cost of BIM adoption is usually considered as high. For example, according to the study by Bahçeci and Polat (2020), the initial investment costs of BIM are high from contractors' point of view.

The cloud programs which are necessary for the proper use of BIM are mostly available in foreign currency. This is also one of the reasons which make the transition to IPD difficult.

Ademci & Gundes (2020) explored the barriers to BIM and pointed out the financial challenges. Cost issues are the most considered challenges for BIM use. According to their research, small and medium-sized firms (SMEs) lack sufficient digital capability and the necessary financial resources to invest in new technologies. Training is identified as a major expense component for organizations, posing a significant barrier to BIM adoption efforts. The cost of investing in BIM comprises the cost of the software to be purchased, the cost of appropriate hardware, and the cost of training to adapt to changes in workflows and technologies (Ademci & Gundes, 2020).

Bozkurt (2016) conducted a survey to examine the driving factors of innovation in the Turkish construction industry and financial insufficiency was found to be a barrier for innovation by the participants. This finding may also apply to firms in the Turkish construction sector in terms of financial insufficiency to cover the investment for educational and technological requirements for IPD.

According to the survey by Tan (2021), the initial investment cost for BIM transition regarding the software, hardware and training is perceived to be high by a majority of AE professionals who pointed out that their companies' financial resources are not sufficient to cover it. Besides, the additional cost of the required consultant support for the proper use of BIM applications is found to be high and this negatively affects the motivation for adopting BIM.

2.4 Concluding Remarks

In this chapter, firstly, the advantages and disadvantages of traditional delivery methods are revealed. After an explanation of why the industry needed a change, IPD was examined, starting from its background, and followed by its comparison with the traditional methods and principles. The updated pool of IPD benefits and barriers is gathered from previous research.

Aligned with prior research, the results demonstrate that IPD is effective for optimizing construction planning, reducing waste, cost, time, and risks. Furthermore, adopting IPD may result in higher AEC project productivity and the resolution of long-standing productivity issues.

Addressing the advantages and challenges of IPD practice is important to help professionals that have not yet experienced IPD use. In summary, the main reasons for the lack of widespread adoption of IPD are uncertainty, high initial costs, contractual difficulties, and implementation complexity. Shorter schedules, lower costs, improved quality, increased productivity, and less construction administration are the key benefits of IPD.

Turkey is a country where IPD implementation has not commenced yet, although IPD is increasingly being adopted globally. This chapter also examined the potential barriers that may be faced during IPD adoption in Turkey. In this concept, potential

barriers are revealed through a careful examination of the IPD barriers provided in previous studies about developing countries.

Organizational barriers to IPD adoption in Turkey are mostly related to BIM use. It is concluded that researchers widely believe that BIM use is the main prerequisite for IPD. The lack of mandatory requirements for BIM use in Turkey is a substantial challenge to overcome. Additionally, there is no document or code issued by the government related to BIM use. As the use of BIM is still at the beginner level in Turkey, the lack of qualified employees that are competent in using BIM is a critical issue to overcome. Contractor companies in Turkey are distant to BIM use transition, and they see the BIM development process as a waste of time.

The potential legal barriers to IPD use are related to Turkey's procurement laws. In Turkey, the contractor is selected based on the lowest bid price, which can result in cost overruns, disputes, and poor quality. Public Tender Law (PTL) is used to tend public projects and the contract types to be used in public projects are defined in the law which are suitable only for an agreement between owner and contractor. Thus, a new legal framework for the use of relational contract type is needed for IPD adoption in the Country.

Although PTL impedes IPD in the public sector and substantial legal changes are required, there have been no barriers to adopting relational contracting for private construction projects. Another barrier in the legal framework is found to be the long evaluation periods in Turkish public offices. Turkish government departments are notorious for their time-consuming bureaucratic processes, leading to rework, poor quality results, time, and cost overruns. Looking from the IPD's view, all the participants are affected by this long bureaucratic process because all parties are involved in the projects starting from the earliest stages.

According to the literature, issues related to BIM use can be classified both in organizational and financial barriers as the initial costs of BIM adoption are usually considered high, especially from contractors' point of view. The cost of investing in BIM includes the cost of purchasing software, purchasing appropriate hardware, and training to adapt to changes in processes and technology.

3 FINDINGS: CASE STUDIES OF IPD IMPLEMENTATION

3.1 Introduction

Success stories from IPD projects have begun to appear in trade publications, and empirical performance comparisons have begun to appear in the literature (El Asmar et al., 2013). The most significant benefit of case studies is that they enable a holistic review. In this part of the thesis, the outcomes of the case studies serve to reveal how project participants benefit from using IPD and the types of difficulties faced in its implementation.

According to Yin (2009), "a case study is a research technique that incorporates an empirical investigation of a particular contemporary phenomenon within its real-life context using various sources of evidence". In this regard, case study methodology has been chosen frequently for researching IPD, a modern and evolving delivery method.

Case study publications are valuable because their outcomes can be applied to other similar projects. The majority of the case studies about IPD were implemented in the United States (Kahvandi et al., 2016). The benefits of IPD implementation are the topic of theory-based articles. Some of the proposed benefits are raised directly in the IPD, while others are identified through comparisons with other methods. The benefits derived from the case studies, on the other hand, are rather special. In case studies, in addition to implementing IPD in a sample project, the benefits of IPD are also shown, including cost and time savings.

Case study results are extremely useful, especially in assisting project shareholders in making well-informed decisions. Collecting quantitative findings of IPD advantages through the case studies is also an effective and valuable step toward assisting construction investors in selecting the appropriate project delivery method. With this viewpoint, the author believes that the outcomes of the case studies conducted in

regard of this study will motivate the professionals to adopt IPD in Turkey, where there is no IPD implementation.

3.2 Case Study Selection and Data Collection

The author believes that understanding the benefits of IPD use is essential for encouraging professionals to adopt IPD who have no previous experience. Furthermore, the author's access to the emerging case study projects offers an excellent opportunity for in-depth research. As an employee of a Michigan-based global AE company that has been in the industry since 1982, called the Ghafari Associates, the author of the thesis had the opportunity to reach the information firsthand, including outcomes, lessons learned, challenges, and profits, contracts, and other data. Two case studies in this part are generated in the light of Ghafari's outcomes from the IPD projects the Company was one of the key members in 2017 and 2018. Both projects were airport amenities and worked collaboratively with the same client but different construction companies through an IPD contract. Each case study begins with an overview of the project's general information, and data such as scope, schedule, and budget are represented. These information are mostly received from the PMs of the project, through the contract agreement(s), and through the marketing sheets of the designer company.

3.3 Case Studies

3.3.1 Case 1: Renovation of Airport Lounge in New England Region

The project is the renovation and expansion project of the special club and lounge at an international airport in the New England Region of USA, with an area of 1500 m². The client was constantly investing in ways to improve the customer experience. In that vein, they embarked on the largest makeover program in the club's 70-year history, implementing new design guidelines across their global network of passenger lounges. Following the designer's successful collaboration on their lounges at the airport in Chicago, the owner decided to enter into an Integrated Project Delivery Agreement again with the same designer for their next project.

This project adds 380 square meters to the 1120 square meter club, located near a terminal gate. The space features a reception lobby, main lounge, dining area with a bar and serveries, conferencing areas, quiet rooms, offices, a kitchen, restrooms, and shower rooms. Drawing on the Architect's experience with the Chicago lounges (also an IPD effort), the Architect was able to interpret client requirements and produce program layouts quickly. The Architect was able to understand cost impacts and constructability concerns thanks to the early collaboration between the design team and the contractor/subcontractors. This was especially critical for effective project phasing, as the expansion area had not been formally identified until well into design development.

An Executive Leadership Team (ELT), a Project Leadership Team (PLT) and a Dispute Resolution Committee (DRT) were formed, consisting of the respective representatives of the Owner, Architect, and Contractor. ELT should make choices, organize, and manage the Project in a way that allows the Parties to meet the Key Performance Indicators (KPI) and complete the project effectively. PLT was in charge of carrying out the ELT's decisions and directions. The PLT should be in charge of the Project's day-to-day management, including the programming and coordination of the Parties' activities to ensure that the project is completed in a collaborative and integrated manner. The PLT should not be responsible for the failure of any Party to perform its obligations. When appropriate, the PLT should plan and implement programs to improve Project performance. The PLT should create and maintain a Project work plan for review and approval by the ELT. The PLT was also responsible for preparing the Change Orders if any issue arises for the approval by the ELT. If the ELT agreed to a change, the Parties should execute a Change Order.

The initial contract price was $600,583.50 which would serve to take the drawings through TOC, The initial amount authorized for the Architect was $307,800.00. The amount corresponding to the Contractor for this phase $292,738.50.

According to the contract, to the extent an Overrun occurs, the Overrun should be paid by the Party responsible for the Overrun in proportion to such Party's responsibility for causing the Overrun. To the extent an Overrun occurs that exceeds the Overrun Cap which is defined by the contract, the Contractor and Architect

should each be responsible for 50% of the amount of the Overrun in excess of the Overrun Cap, irrespective of any fault or alleged fault of any Party. The Owner assumed the risk of design and construction errors, omissions, and defects that cause an Overrun other than those caused by or arising out of Full Recourse Obligations, provided that any Profit and At-Risk Overhead of the Non-Owner Participants should first be fully applied to offset any Overrun. If an Overrun exceeds all Profit and At-Risk Overhead of the Non-Owner Participants, the Owner assumed the risk of such Overrun up to a cap of $500,000.00 (the "Overrun Cap"), and any portion of an Overrun that exceeds the Overrun Cap shall be paid by the Contractor and Architect, each being responsible for fifty percent (50%) of the amount of the Overrun in excess of the Overrun Cap, irrespective of any fault or alleged fault of any Party. According to the contract, the underrun would be split 50/50 between the owner and non-owner participants, and 50% of total savings would be distributed as 70% to the Contractor and 30% to Architect.

The design stage started on 18th May 2017 with the assignment of the contract and was completed on 28th December 2018.

This project was named as an example of a successful IPD implementation by the project owner. Six KPI metrics were defined in the scope of the contract: positive customer experience, operator's coordination, stakeholder satisfaction, safety, security, and zero airport customer complaints. The Key Performance Indicators were met and at the end of the project, designer and contractor were both awarded Shared Savings and KPI performance funds.

The following data is taken from the Final Cost Forecast reports as of 20th November 2019 and shows that project was completed with a 9.24% underrun of TOC to be shared.

Estimated TOC = $13,918,697

Forecasted Cost at Completion = $12,632,190

Projected Underrun (shared savings) = $1,286,507 (9.24% underrun of TOC)

3.3.2 Case 2: Renovation of Airport Lounge and Concourse in the South Central Region

The project is to renovate the airport lounge with an area of 585 m² and the concourse space with an area of 7430 m². The customer requests to renovate and enlarge the terminal's existing airport lounge as well as convert the existing nine-gate independent concourse into a fifteen-gate dedicated regional jet operation. Following the designer's successful collaboration on their lounges at Chicago Airport and the airport in the New England region which is the subject of Case 1, the owner decided to enter into an Integrated Project Delivery Agreement again with the same designer for this project.

The goal was to create a relaxing and unwinding environment that would complement the newly upgraded satellite concourse, paying regard to the client's current branding standards. The design included adding six contact gates, reconfiguring and modernizing hold rooms, and improved ramp level rooms, such as break rooms, shops, and repair areas to meet grooving passenger numbers with the criteria of serving the client's various user groups. With the IPD contract they signed, they had successful results in just under 13 months enabling them to expedite the effective discovery, scope definition, design, and implementation of the required work. Project design kicked off in April 2018 and terminal opening scheduled for May 2019 to meet the client's flight schedule. The team met a fast-track schedule and the terminal opened on time.

An Executive Leadership Team (ELT), a Project Leadership Team (PLT), and a Dispute Resolution Committee (DRT) were formed, consisting of the respective representatives of the Owner, Architect, and Contractor.

The initial contract price was $1,553,300.00, including $809,190.00 for the Architect, which provided for the Program Development and Criteria Phase through the Implementation documents Phase and included a sum of $27,664.00 for reimbursable expenses. The initial contract price included $744,110.00 for the Contractor.

The parties intended to establish a Total Output Cost (TOC) for the project and to amend the agreement to incorporate the TOC. Any savings realized in accordance with the agreement should be shared by the parties to the extent that the Actual Cost was less than the Contract TOC.

The project manager of the design company was one of the professionals to whom the author interviewed for the interview phase of this thesis. According to the project manager of the designer, the project went through numerous changes and added scope, which really disrupted the IPD project contract. The design team ended up amending the TOC to capture the additional scope about eight different times.

The agreement also stated that the PTMs' agreement would end once the project was completed and all terms and conditions of the prime contract, including warranty obligations, had been met. At that point, the profits were to be determined, adjusting for any cost overruns that may have occurred. Profits would be distributed to the PTMs according to a formula previously agreed upon. According to the contract, the underrun would be split 50/50 between the owner and non-owner participants. With respect to the non-owner participants' share of any underrun (50% of total), the non-owner participants' share would be distributed as follows: 70% to Contractor and 30% to Architect. Owner's, Architect's, and Contractor's risk were defined the same as they were defined in Case 1's contract.

This project was also an example of a successful IPD implementation. Although the team faced several changes, the Key Performance Indicators were mostly met. at the end of the project designer and contractor were both awarded Shared Savings and KPI performance funds. Eight KPI metrics were defined in the scope of the contract. One of them was the goal for 30% or greater minority participation for the project. 33% Disadvantaged Business Enterprise (DBE) was provided which met the first KPI. Another met KPI was the fast track schedule. The team met a fast-track schedule and the terminal opened on time. Value Engineering was expected to be done in the content of KPI. Tunnel baffles were removed from the project scope and replaced with acoustical ceilings, elevator foundations were redesigned, back of house lighting was removed from the scope to increase cost savings. In order to meet the terminal opening date of May 2019, the team was required to provide multiple packages and permits to facilitate expedited reviews and approvals from the airport

operator. Multiple phases of occupancy and inspections needed to be coordinated with the operator to complete construction on schedule. This KPI was also remarked as met.

The following data is taken from the Final Cost Forecast reports as of 11th December 2019 and shows that project was completed with a 14.9% underrun of TOC to be shared.

Total project budget= $40,456,397

Projected TOC Original Funding= $34,962,930

Preliminary TOC (03-08-19)= $35,111,746

Ammended TOC (08-23-19)= $38,082,791

Actual Cost Billed to date (11-12-19)= $31,049,938

Forecasted Cost at Completion = $32,395,512

Projected Underrun (shared savings) = $5,687,279 (14.9% underrun of TOC)

3.4 Findings and Discussion

The author closely examined two IPD projects by conducting exploratory case studies. These projects had the same owner, same designer, different contractors. Both projects were airport amenities. Table 3.1 gives a summary of each case studies' findings.

Table 3.1 Findings of Case Studies

Case Studies	Case 1	Case 2
Project Date	2018	2019
Project Location	New England Region	South Central Region
Project Area	1500 m²	8015 m²
Duration	19 months	13 months
Estimated TOC	$13,918,697	$38,082,791
Forecasted Cost at Completion	$12,632,190	$32,395,512
Project Underrun of TOC	$1,286,507	$5,687,279
Underrun Ratio	9.24%	14.90%

As shown in Table 3.1, each project was an example of the successful implementation of IPD in terms of schedule and cost. Apparently, after seeing the successful result of Case Study 1, the owner decided to work with the same designer for its next project under the IPD contract, which is the topic of Case Study 2.

The durations of both projects were squeezed as much as possible with IPD use. Early involvement of the key participants appears to be the most significant factor contributing to the compression of schedules. In this regard, the contractor's comments on the possible constructibility issues were valuable to shape the design during the design phase, resulting in no rework, fewer RFIs, and no CO. Each party benefited from the shared savings related to its share ratio defined in the contract.

In other words, several benefits of IPD use were recorded from the exploration of case studies. These are listed as follows:

- Fast-track project delivery
- The operation of the buildings started earlier
- Shared savings

- Long-term relationships between the involved parties

The common problems of traditional delivery methods such as long delivery durations due to disputes and delays, adversarial relationships between designer and contractor, poor production, schedule overruns, and budget overruns were not recorded from the exploration of case studies. The early involvement of key parties can be shown as the main reason.

4 FINDINGS: SEMI-STRUCTURED INTERVIEWS

4.1 Introduction

To gather a full understanding of perceived barriers to implementing IPD, a qualitative approach incorporating semi-structured interviews was used. The use of a qualitative methodology allows for additional insight into the opinions, experiences, and thoughts of participants (Ward & Holman, 2001). When the interviewer does not exactly follow a pre-determined list of questions, it is referred to as a semi-structured interview. Instead of a straightforward question and response approach, they will ask more open-ended questions, allowing for a discussion with the interviewee. Furthermore, rather than filling out a survey questionnaire, a semi-structured interview provides a relaxed atmosphere that is suitable for data mining in qualitative methods since the participant can have an involved dialogue without feeling distant (Woods, 2011). As a result, it will enable in-depth talks while also exploring the essential aspects of data collection.

4.2 Interview Design

In this section of the thesis, interviews with people who participated in the IPD projects were used to gather qualitative data after the case study method was utilized during the data collection process. Also, this section introduces how the interview form is prepared, which is used for data collection.

Interview questions are designed with the outcomes of the literature review stage. Since interviews and surveys are often used to research an evolving method, previous research on IPD focused on real-life outcomes. Table 2.7, given in Chapter 2, summarized the studies that focused on IPD practitioners' experiences through surveys and interviews, and the outcomes from the review have shed light on the design of the interview questions.

To gather more detailed answers, some possible answers were listed by the author, but the respondents were encouraged not to limit their responses to the options listed at the end of each question. In this way, interviewees could have a quick reminder that would help them better express their experiences and project outcomes. These possible answers were again obtained from the literature review mentioned above.

During interviews, a total of 14 questions were provided to the respondents. First, a general information part (part 1) was designed to capture the personal information about the participants. In this part, their role and experience in the construction industry were asked. Asking their role was vital because it would lead the author to determine which part of the questions should be asked to each participant: owner, contractor, or designer. Since all stakeholders would have different acquisitions and experiences from IPD, the questions varied for each key stakeholder.

Asking the participants about the delivery methods they had experience with was also critical because comparing IPD with other delivery methods as per their real-life practices is crucial for revealing the benefits and challenges of IPD implementation.

In the last question of the general information part (part 1), the interviewees were asked how many and which types of projects they have delivered using IPD. This question was also important to better understand whether certain types of projects are more suitable for IPD use or not.

After general informative questions, the respondents were asked different questions depending on their role in the IPD project (Part 2). As stated before, the questions in this part differed depending on the interviewee's role. For instance, the first question was about the decision on IPD use. While owners were asked how they decided to award IPD for their projects, designers and contractors were asked how they determined their company was ready to be in an IPD team. Because choosing the type of delivery for the project is generally the owners' choice. Another example of how the questions differ accordingly to the stakeholder's role is the second question. Which factors are considered to adopt IPD for their projects was asked to owners. However, to designers and contractors, which factors are considered to be involved in an IPD team.

Another example of how the questions differed accordingly to the stakeholder's role is the second question. Which factors are considered to adopt IPD for their projects was asked to owners. However, designers and contractors had to reveal which factors are considered to be involved in an IPD team.

The questions related to the benefits of IPD use were inspired by the classification given in Table 4.1, which is reprinted from the research by Alinezad et al. (2020). It was seen that interviews with the participants who had different roles in an IPD project could reflect different types of benefits.

The questions related to barriers are generated with the outcomes of Table 2.8 that was given in Chapter 2 of this thesis.

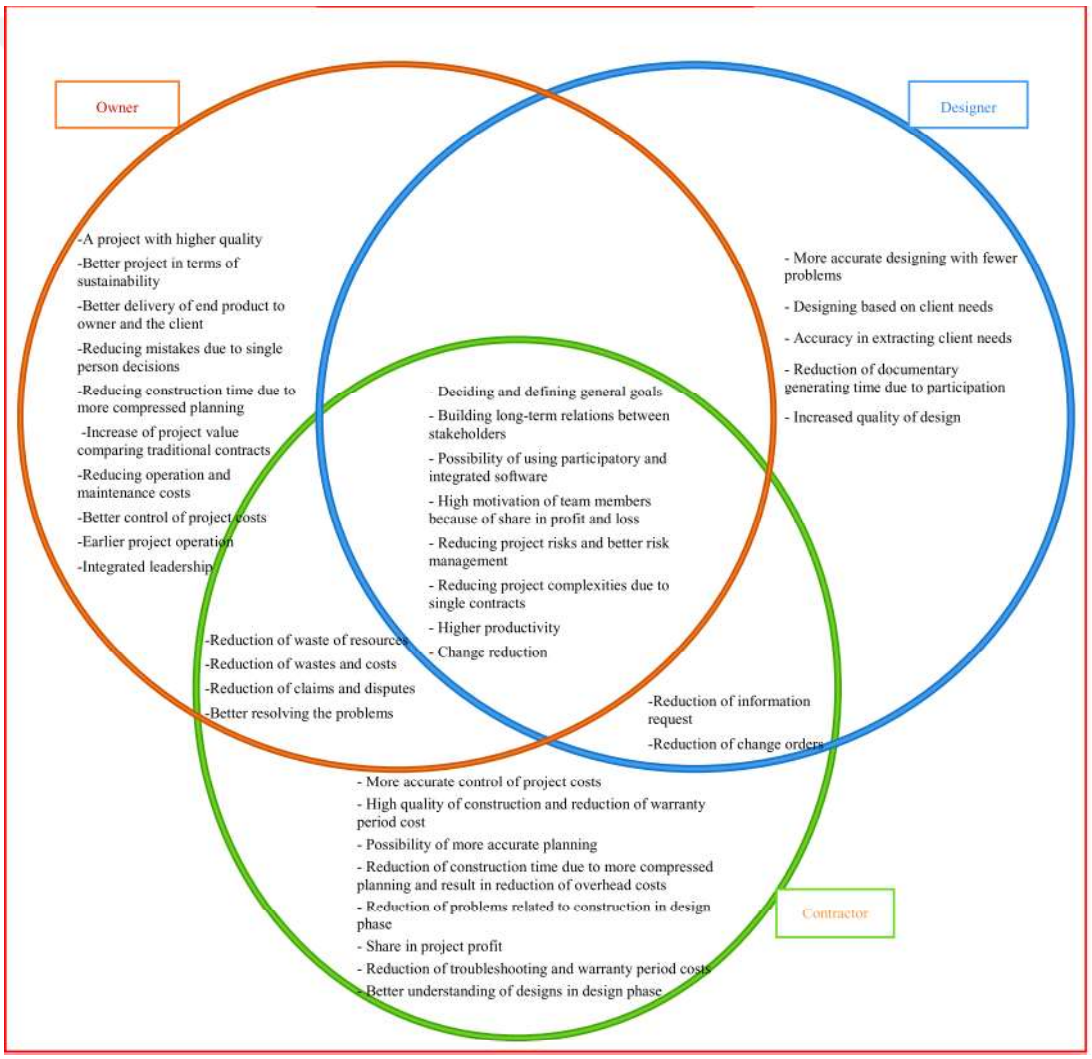

Figure 4.1 Benefits of IPD implementation for project stakeholders

(Alinezad et al.,2020)

4.3 Data Collection

The data for this study was gathered from professionals in this field who are experienced with the construction industry and IPD and have the authority to make decisions in their organizations.

Since our world is suffering from the Covid-19 Pandemic, all work processes are affected. All interviewees part of this research are from the USA. Meeting schedules are needed to be considered with the aspect of working remotely and extended work hours, limited with the time zone difference. Five professionals were interviewed via Microsoft Team's online conference platform, and finding a suitable time for meetings was challenging due to all working processes were being performed via conference calls. Two interviewees were from the designer's side of the IPD teams, employed in Ghafari Associates LLC in the USA office. Two professionals were key participants from the contractor and owner side of IPD projects which Ghafari designed. One participant who has relationships with IPD practitioners of Ghafari was communicated via LinkedIn. The interviews were carried out between June and November 2021 and averaged an hour in duration.

The participants are only identified by their numbers in order to sustain individual confidentiality (i.e., owner O1-O2; constructor C1; designer D1-D2). The interviews were conducted via Microsoft Teams and were recorded with participants' consent and transcribed verbatim. During the interviews, detailed notes were also taken.

Table 4.1 below displays the detail of the interview participants for this research;

Table 4.1 Participants details

Label	Party	Position	Experience (year)	Country	Interview Date
D1	Designer	Project Manager	13	USA	18-06-2021
D2	Designer	Project Manager	27	USA	06-08-2021
C1	Contractor	Project Manager	22	USA	15-10-2021
O1	Owner	Consultant	30	USA	23-08-2021
O2	Owner	Project Manager	42	USA	18-11-2021

4.4 Findings

The 'data findings,' which were gathered through a semi-structured interview session and qualitative data analysis method, have been described as a substantial

contribution to this study. During the data interview collection, the interaction between the researcher and the participant, all of the conversations are recorded using Microsoft Teams' recording feature as an mp4 format to absorb all of the information from the participants without any single word left. These video call files were converted into audio in .wav format with VLC Media Player Software. Audio files in .wav format were converted to word format using Python (www.python.org) programming language and pydub, os and speech recognition libraries and modules through the code taken from 'https://www.thepythoncode.com/code/using-speech-recognition-to-convert-speech-to-text-python' webpage written below:

```
# importing libraries
import speech_recognition as sr
import os
from pydub import AudioSegment
from pydub.silence import split_on_silence

# create a speech recognition object
r = sr.Recognizer()

# a function that splits the audio file into chunks
# and applies speech recognition
def get_large_audio_transcription(path):
    """
    Splitting the large audio file into chunks
    and apply speech recognition on each of these chunks
    """
    # open the audio file using pydub
    sound = AudioSegment.from_wav(path)
    # split audio sound where silence is 500 miliseconds or more and get chunks
    chunks = split_on_silence(sound,
        # experiment with this value for your target audio file
        min_silence_len = 500,
        # adjust this per requirement
        silence_thresh = sound.dBFS-14,
        # keep the silence for 1 second, adjustable as well
        keep_silence=500,
    )
    folder_name = "audio-chunks"
    # create a directory to store the audio chunks
    if not os.path.isdir(folder_name):
        os.mkdir(folder_name)
    whole_text = ""
    # process each chunk
    for i, audio_chunk in enumerate(chunks, start=1):
        # export audio chunk and save it in
        # the `folder_name` directory.
        chunk_filename = os.path.join(folder_name, f"chunk{i}.wav")
        audio_chunk.export(chunk_filename, format="wav")
        # recognize the chunk
        with sr.AudioFile(chunk_filename) as source:
            audio_listened = r.record(source)
            # try converting it to text
            try:
                text = r.recognize_google(audio_listened)
            except sr.UnknownValueError as e:
                print("Error:", str(e))
            else:
                text = f"{text.capitalize()}. "
                print(chunk_filename, ":", text)
                whole_text += text
    # return the text for all chunks detected
    return whole_text
```

Part 1 of the interview included questions to gather general information about the participants. The first question, which is shown in the screenshot from the interview page (Figure 4.2), was about their role in the construction industry

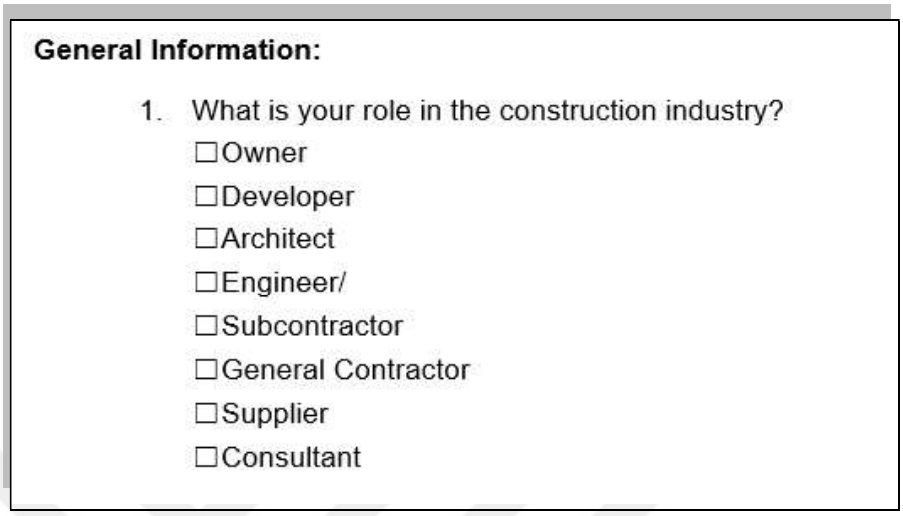

Figure 4.2 Part 1 Question 1 of the interview

D1 labeled interviewee checked Engineer option since he was an Electrical Engineer who was part of an IPD team as a project manager of design company. D2 labeled interviewee checked the Architect option, again he played an important role in an IPD team who represents the design company. The interviewee who is labeled with C1 checked the General Contractor option representing the contracting party of an IPD team as a project manager. O1 labeled participant was a consultant who spoke in behalf of the owner team. O2 labeled participant was the owner.

The second question of Part 1 was to learn the experiences of the participants. Learning their experiences in the industry was necessary because their responses would be more reliable as they compared the delivery methods and approaches parallel to their expertise. D1 labeled participants had 13 years old work experience in the AEC industry. He remarked that he was an electrical engineer by trade; he had been doing project management for the last five years. Participant D2 said he had 27 years of experience in the industry. Participant C1 remarked that he had 22 years of experience which he has gained in the same company since he began. O1 indicated that his experience in AEC industry was 30 years. O2 labeled interviewee indicated that he has 42 years of experience in the industry.

Question 3 of Part 1 was asked to gather the participants' experience with the project delivery methods. This question was critical because comparing IPD with other delivery methods as per the participants' real-life practices was crucial for revealing the benefits and challenges of IPD implementation.

D1 interviewee responded by remarking he had experience with DB, DBB, and IPD. On this point, his opinions for each approach was asked, and his answer was as follows:

> *'To manage each delivery method, there are different pieces to each one as pros and cons. The DB is nice in the way that you get direct access to the client. The clients are making the decisions. In DB, you are working for the contractor, and you don't really know if the contractor is taking all of the owners' information properly, and we don't have as much control over quality control and things like that. If you haven't a trusted contractor, it makes a world of difference in that. The IPD is nice because the biggest benefit of IPD is having the contractor comment on the constructability of certain design approaches, look at the existing conditions, and come up with more ideas to how the best approach is. Managing IPD is preferable to me personally just because you have that direct owner access. And I think there is a certain feeling of ownership on the project because we are all part of the same decision-making process and share the profits and losses. Everyone wants to do a good job, and everyone cooperates with one another, whereas you don't really see that in a DBB or even in DB.'*

D2 and C1 interviewees responded that they experienced DB, DBB, CMR, and IPD. O1 indicated that he had experience with DB, DBB, BOT, CMR and IPD. O2 remarked that he had worked on DB, CMR, and IPD.

Question 4 was asked to gather how many IPD projects they part in and what was the projects' types. D1 pointed out that he had been involved in two IPD projects, and both were aviation projects which were explained in the case studies of this thesis. D2 interviewee answered that he worked with four IPD projects which all were aviation projects by the same client. C1 labeled participant remarked that he worked

with one full IPD aviation project which designed by the company that the author's been working for and three IPD light projects. At this point, if any differences between the projects with true IPD and IPD light projects experienced by C1 was asked. He explained as follows:

> *'I am sure you've heard the term of IPD light, which is mentioned as IPD-ish in the literature also. In some of our projects, we were asked to use the principles of IPD for all team members, but there wasn't any IPD contract. In the IPD contract, you get absolutely the fullest of the whole IPD process. The IPD-ish contracts were still good because we had people that were acting as if there was a real IPD contract. So there were still benefits of using IPD. Participants were still keen on having IPD's principles even there is not an IPD contract and that was proven by the owner because they were the ones that were asking the contractor and the designers to act as if it wasn't IPD contact and have the required collaboration.'*

O1 pointed out that he had been working on IPD projects for over 20 years, and he finished five projects adopting IPD. O2 remarked that he's worked on only one IPD project till now.

After the Part 1 questions are finished, Part 2 questions are asked to the participants according to the parties that they represent. The first question was asked to learn how their companies decided that they are ready to participate in IPD projects and which metrics and tools are used to assess their organization's readiness to implement IPD.

D1 interviewee answered that financial sufficiency, technology, BIM skills, and understanding of the IPD concept were important metrics to decide if the designer company was ready to participate in an IPD project. He also added that having BIM skills is less considered for IPD use because he thinks BIM skills are now required for any type of project.

> *'BIM skills are not unique to IPD; it is necessary for any type of project. It is also possible to execute successful IPD projects with less BIM skills. It is, of course, beneficial but not a requirement because I see the IPD process is more about contractual and management issue.'*

D2 interviewee answered Question 1 as technology and understanding of IPD concept was critical to assess their firm was ready to IPD and added that feeling comfortable about the legal aspects of IPD was the moment they decided they were ready to implement IPD as a design company with below explanation:

> *'Basically, the biggest issue associated with that we had to get past the risk issue. And that was the real hurdle for us, so when I say the risk, I mean even the IPD contract was an instrument that was recently new to the industry, and we had to be satisfied to take on that liability. That took a little convincing, persuasion, deliberation. We had to pass that point before we were ready. We were certainly prepared when we took on the first project with technology and understanding the IPD concept in theory. We had faith that the other parties are going to understand it and act appropriately. Some of the contractors that were interviewed for the first project by the owner, were squeamish about IPD, they didn't want to do it. They weren't familiar with IPD and they weren't comfortable and they considered to refuse to sign a contract. Ultimately I think that was the biggest issue and hurdle but we were comfortable with the legal aspects of IPD, then we knew we were ready.'*

C1 labeled participant responded by saying technology, BIM skills and understanding of IPD concepts were important to decide if their company was ready to IPD use as a contractor. He mentioned the times his firm decided to take part in an IPD project for the first time with these words:

> *'Our first IPD project was an aviation project, and actually, I was finishing my master's degree at that time and had a course on IPD. This opportunity with the owner, who was one of our clients, came out and we interviewed for the job. I brought what I learned in my master's to passion a proper knowledge of IPD. And that time, we had the technology and sufficient BIM skills already. So I didn't feel like there was a barrier of entry. Even we hadn't done any IPD projects at that time, I had a good understanding of IPD. That's why we felt we were ready to take on a project with IPD. We knew the owner before, so that was also incentive too.'*

The first question is asked in a different way to owners. Since the owners are the ones who decide on the project delivery method to be used, it is asked how owners decided to use IPD for his projects. O1 answered that the considerations on deciding IPD use on a project were fast-track delivery, mitigating project risks, maximizing project value, and overcoming project complexity. O2 labeled participant's answer was quite different than others. He mentioned that they wanted to experience IPD on a random project to see how it worked for future decisions. However, he also aimed to mitigate the project risks and maximize the project value.

The second question was asked to understand which factors are considered when deciding to involve in an IPD project. D1 answered by telling the project size, complexity, budget and schedule are considered during this decision. He explained that IPD could be applied to any project type, but if there is a tight schedule or budget for example, IPD gets more beneficial for the project.

Participant D2 answered this question by pointing out that complexity, budget, and schedule are considered for the IPD decision. He remarked that the budget is seen as a little weaker factor compared with the complexity and schedule.

The answers for the C1 and O1 interviewees were project size, project type, complexity, budget, and schedule. According to C1, if it is a small project in terms of cost and it may have a short schedule but not a very complex project, then it is not a candidate for being an IPD project with not having a lot of risks and budget concerns. After that, he gave an example for why one of his projects were suitable to use IPD with these words:

> *'In the case of the IPD project I took part in, I can say that it was a large project in terms of dollars. It was also a very complex project because the airport facility had to be open while construction took place, which means multiple phases were required to keep the facility open. There were complex and high-end finishes that needed to be coordinated. So that project is more of a candidate for IPD where everybody shares risks and rewards rather than a simple, straightforward project that doesn't have a lot of variables. I can say*

that if there is something problematic with the project, then it is a good candidate for IPD because it will benefit the IPD better.'

O2's answer was similar to his response to the first question. He explained that regardless of project size, type or complexity, they wanted to experiment with IPD.

In Question 3, the participants were asked to indicate the parties integrated into the IPD projects that they have experience with. D1 and D2 remarked the IPD team he took part in included the owner, designer, and contractor. C2 answered by indicating that he was involved in the IPD contract which included owner, designer, contractor, and consultant. Furthermore, C2 shared his opinions on the complexity of IPD teams according to who are involved in:

'It is more complicated when involved in a team that includes owner, designer, contractor, suppliers/subcontractors. In a particular project, we discussed bringing some of the key subcontractors into IPD but it ended up deciding not to, just because we felt that there wasn't enough reason to bring them into shared risk and reward.'

O1 answered by saying that he took part in IPD teams that comprised of owner, designer, contractor, suppliers and owner, designer, contractor, consultant. O2 responded by saying that he experienced owner, designer, contractor team of IPD.

Question 4 asked the accrued benefits through IPD use for the participants' projects and the most significant ones. D1 indicated that the following benefits were taken: building long-term relations between stakeholders, reducing project risks and better risk management, change reduction, more accurate designing with fewer problems, reduction of documentary generating time due to participation, increased quality of design, share in project profit, reduction of information requests, and reduction of change orders. He pointed out that reducing project risks and better risk management, change reduction, and sharing in project profit were the most significant ones.

D2 remarked that reducing project risks and better risk management, higher productivity, increased quality of design, share in project profit, reduction of information requests, and reduction of change orders were the benefits he experienced during his IPD projects. He expressed that the reduction of change

orders and information requests was significantly beneficial. He also added that reduction of finger-pointing by others and being blamed was a particular benefit of IPD use.

C1 labeled interviewee's answer for Question 4 with the contractor's point of view included following features: 'deciding and defining general goals, building long-term relations between stakeholders, high motivation of team members because of share in profit and loss, reducing project risks and better risk management, reducing project complexities due to single contracts, higher productivity, change reduction and less rework, reduction of problems related to construction in the design phase, reduction of construction time due to more compressed planning and result in a reduction of overhead costs, the possibility of more accurate planning, more accurate control of project costs, share in project profit, a better understanding of designs in the design phase, reduction of waste of resources, reduction of claims and disputes, reduction of information requests and reduction of change orders'. He added as giving his further opinions to benefit IPD for projects:

> *'The number one factor, in my opinion, is the team. If you have the right team, then IPD could be very successful. If everybody buys in, then it works well. You are going to have higher productivity from the designer's side; the contractor is going to be involved in the design which is going to happen to better understanding of the project and why it's designed that way, which is going to result in better quality work and less change, less claims and better schedule, if the team is going towards a common goal.'*

O1 answered that owner's side benefits accrued during IPD use were reducing project risks, better risk management, and higher productivity.

The extracted benefits of implementing IPD by O2 were 'reducing project risks and better risk management, reducing project complexities due to single contracts, reducing construction time due to more compressed planning, better control of project costs, and reduction of claims'.

For Question 4, Table 4.2 summarizes which benefits are gathered from each participant while the IPD projects were executed that they involved in. The extracted benefits are listed with their total credits by the interviewers.

Table 4.2 Benefits gathered by the interviewees

Benefits	D1	D2	C1	O1	O2	Rating
Reducing project risks and better risk management	X	X	X	X	X	5
Higher productivity		X	X	X		3
Share in project profit	X	X	X			3
Reduction of information request	X	X	X			3
Reduction of change orders	X	X	X			3
Reduction of construction time due to more compressed planning and result in reduction of overhead costs			X	X	X	3
Change reduction and less rework	X		X			2
Building long-term relations between stakeholders	X		X			2
Increased quality of design	X	X				2
Reducing project complexities due to single contracts			X		X	2
Reduction of claims and disputes			X		X	2
Better resolving the problems			X		X	2
High motivation of team members because of share in profit and loss			X			1
Deciding and defining general goals			X			1
Reduction of problems related to construction in design phase			X			1
Integrated leadership				X		1
Possibility of more accurate planning			X			1
More accurate designing with fewer problems	X					1
Designing based on clients needs			X			1
Reduction of documentary generating time due to participation	X					1
Better understanding of designs in design phase			X			1
Reduction of waste of resources			X			1
Increase of project value comparing traditional contracts				X		1
More accurate control of project costs					X	1
High quality of construction and reduction of warranty period cost						0
Accurancy in extracting client's needs						0
Possibility of using participatory and integrated software						0
Better project in terms of sustainabilty						0
Reducing mistakes due to single person decisions						0
Reducing operation and maintenance costs						0
Earlier project operation						0
Reduction of troubleshooting and warranty period costs						0

Question 5 was what the challenges were faced in the design and implementation of IPD projects. D1 labeled participant's answer was the lack of experience with IPD components, group decision-making, and identifying objectives and performance measures. He explained how the group decision-making as:

> *'I would say certain things came up that put more risk on the contractor in doing a certain task. Where the designer and the owner are like, ''let's do that'', the contractor says that his company is at risk by doing that and points out that it is not really fair to them. Making sure that all parties agree if there is an issue like this, everyone knows that they have to come to a solution quickly, so it really forces the dialogue between the parties to find the right solution. If there are contentious issues that have more risk to one party versus another, that is where it gets a little horse-trading.'*

While D1 remarked the lack of experience with IPD components is a challenge, the D2 interviewee indicated that it is more owner's problem. He listed the challenges for the design party as building and sustaining a collaborative environment and establishing mutual respect and trust. He gave his opinions in more detail with the following explanation in terms of the behavioral aspect of involving in an IPD team:

> *'In my experience, lack of experience with IPD components hasn't been too much of an issue, although that's more of a problem on the owner side because conceptually, architects are the most welcoming party to IPD. We've always been the ones who embraced IPD on the four projects that I was involved in with open arms. Contractors and owners like IPD in theory, but once they got into the practical elements of it, they really didn't necessarily know how to execute or understand how IPD was going to work for them. There was always a learning curve associated with that for the contractor side on how to behave. Because contractors are used to telling designers the way it's going to be and trying to find a problem in the designer's drawings rather than cooperating with you and eliminating any possibility for changes. It goes against a lot of their mentality. I think that was a challenge that we had to get passed on.'*

For the interviewee labeled C1, the challenges he faced in the implementation IPD were building and sustaining a collaborative environment, establishing mutual respect and trust, lack of experience with IPD components, group decision-making, and identifying objectives and performance measures.

According to O1, the only challenge faced in implementing IPD was selecting the right team.

The challenges faced by O2 were trades' and consultants' reluctance to participate in IPD, establishing mutual respect and trust, and lack of experience with IPD components.In this point, O2 mentioned that establishing trust was the biggest problem for his company's perspective. He explained with these words:

> *'The owner rely on the contractor to come up with the cost. At the end, if you save money, then the costs are shared. The issue is, do you*

really trust the contractor they were accurate on the budget? Because if the contractor shows it as a higher cost, so it can earn more savings in the end. This is a huge trust issue.'

After he explained the hardness of establishing trust, he remarked another challenge, lack of experience with the IPD components:

'IPD is a relatively new contracting mechanism. And most people have not done it before, and contractors will still think like contactors even though it's IPD, it is so hard to get the contractors out of that mindset. I guess they won't behave as partners with the owner but will think about their own interests rather than the project's sake. This is also about trust, but it is revealed by lack of knowledge. Another issue is there are different versions of IPD. In other words, various contracts, versions, wordings. Because of that, getting each party to agree to a format is problematic. While we were working on the contract of our IPD project, there was a lot of back and forth in terms of the contract language. We were going to give that project to a different contractor but we couldn't come to terms on the agreement, so we ended up and went to the next contractor.'

Table 4.3 summarizes the challenges faced by each participant, arranged in the order of their total credits.

Table 4.3 Challenges faced by the interviewees

Challenges	D1	D2	C1	O1	O2	Rating
Selecting the right team		X	X	X		3
Lack of experience with IPD components	X		X		X	3
Group decision-making	X		X			2
Identifying objectives and performance measures	X		X			2
Building and sustaining a collaborative environment		X	X			2
Trades' and consultants' reluctance to participate in IPD					X	1
Establishing mutual respect and trust					X	1
Documenting and tracking information						0
Changing team members along the project						0
Overshadowing designers						0
Cost and schedule reduction as key targets						0
Focus on 1st cost. Not life cycle cost						0

After these common questions for designers, owners and contractors, the following questions show differences according to the interviewee's role in the industry. The next question (Question 6) was asked only to the designer to gather their opinions on the involvement of the owner and the contractor in the design phase and if there were any advantages or challenges. D1 answered by pointing out that the advantage to having the contractor involved during design is that they can provide insight on certain design approaches and constructability issues before construction begins.
D2 shared his opinions, starting with how to success in IPD:

> *'Identifying project goals and roadmap is really a key factor for an IPD project success and is advantageous.*
>
> *IPD was helping us not to overdesign because we knew the limitations and borders with the contractor's involvement. For example, suppose we want to design an elevator somewhere. In that case, the contractor can say that this is not a very good idea because there are some utilities over there that are impossible to relocate. So, this also affects the schedule in a good manner, designer doesn't spend waste time designing anything that are actually unsuitable.*
>
> *The beauty of IPD that I see, it is balanced by the owner. When it comes to a critical decision, the owner is like a judge and says to the contractor and designer, I see your point, and I understand what you are suggesting, but let's move on with this. Can you do that? We can not see such conversations between the owner and designer, and contractor in traditional delivery methods.*
>
> *In terms of the challenges of IPD, there are a few compared to the huge advantages.'*

Question 6 of Part 2 for owners, the main reasons for selection or not selecting IPD for projects considering mentioned benefits and challenges. O1's answer was saying:

> *'IPD requires a level of investment such as client leadership, intellect, effort, time, and money, to configure your project for success. Some clients are not prepared to invest; the size and scale of some projects*

don't warrant the investment because the effort to value ratio would not warrant it.'

Question 7 in Part 2, prepared for design teams, was asked if designer companies see any business risk on IPD implementation. D1 answered this question by saying that the risk comes if the project is not profitable as each party shares in the risk of project cost overruns. D2's response was:

'There is a business risk in any approach. The real truth to IPD is that you want to go into IPD arrangements with trusted partners. IPD is always a little bit risky with a contractor you work with for the first time.'

Question 7 was common with the contractors' part, asking if IPD is a risky business for contractor companies. C1 pointed out the business risk for IPD is not greater or not less than the risk in traditional delivery methods.

'That would be a risk in your not taking more risk on not getting the benefit of less risk that IPD offers.'

In this point of the interview session with C1, it is asked which party benefits more from IPD use. His ranking was:

'The owner gets the maximum benefit. Then the contractor takes advantage of IPD because they can get the ability to understand the design from the beginning and be able to offer their ability to influence the design. After that, the designer's benefits are fewer design irritations, less construction administration works, and answering fewer RFIs.'

C1's additional opinions were valuable to light the way to understand how IPD reduces stress on contractor companies.

'The construction industry is very stressful for all participants. The owner heads that the project to be done in this way or that way, will make every other one works, but the contractor shoots pace to respond to face solving the problems. I think the most stressful part belongs to the contractor. In my experience, IPD projects have

been less stressful than a traditional delivery project because there are less changes, less claims, less schedule issues, more collaboration between all stakeholders.'

The business risk of IPD was asked as Question 11 to the owners. O1 answered by saying he didn't see IPD as a risky business with these words:

'The industry has evolved towards specialization around trades because scope and risk can be apportioned with greater clarity. In reality, design and construction projects are not silos, and they are only delivered successfully when design and construction are fully integrated. Traditional models that create these silos at the outset, often adopt a 'divide and conquer' approach or struggle throughout the whole delivery process to reknit that integration back together. Still, because such contracts don't facilitate this easily, they struggle because the supply chain members are only seeking to optimize their silos and not that of the wider project.'

O2's answer was based on trust again. According to him, if mutual trust is established between parties, there is no business risk at all.

In Question 8, it is asked that if there was any training on IPD for the employees of the design team. Both D1 and D2 participants' answers showed that they had no training. Furthermore, D2's opinions on training were valuable:

'We were following our procedures associated with normal traditional delivery. There is a lack of training as it relates to IPD. And I believe that every firm that engages with IPD should have someone who champions that process and trains a project team at the outset or at least refreshes them on the guidelines and on what the protocols will be for behavior and communication.'

This question is also asked to the contractor interviewee. C1 answered that his company had not done any training for an IPD project. He indicated that it would be good to discuss, especially open communication behaviors, and sharing information in collaborative and trusting environments.

Question 9 for designers asked if there are any differences between the designer's fees for an IPD project and the traditionally delivered projects in terms of risk-sharing. The responses of D1 and D2 were quite parallel to each other, telling that in IPD, the fee is not limited by being at a bidding process or competition. D2's answer was illuminating:

> *'In general, IPD fees are higher. There are two reasons why fees are higher. One of the reasons is that you will be in a typically less competitive situation; in other words, you are collected based on your qualifications and reputations. Typically there is a little bit more cushion under the fees in our experience. Because there is an opportunity to share savings, you will even be more comfortable about your fee. IPD is definitely a little bit more advantageous from a fee perspective.'*

The last question for designers was asking the most significant advantage of IPD for a design company. D1 answered by indicating the most significant benefits are less rework and profit-sharing. D2's response explained the collaboration is the most important advantage to produce the most creative and best solutions for the project. The other advantage from the point of the designer's view was the probability for success, and the probability for greater value is higher with IPD.

This question was also asked to the contractor interviewee to gather the opinions of the contractor side on the most significant advantage of IPD. C1 answered by remarking that shared savings, less rework, shorter schedule, and less NCR.

The 6th question for the contractor and owner asked to compare IPD projects and traditionally delivered projects in terms of punch lists, claims, closeout procedures, and contract management. C1 answered by explaining that there was definitely a reduction in the amount of punch list, because the design team is more involved in the project and the contractor understands the intent of the design better, which leads to higher quality work.

> *'One of the great benefits of IPD is the reduction of punch list items.'*

C1's response comparing IPD and traditional project delivery in terms of contract management based on experiences said that managing the contract became a lot easier; there were not as many change orders, re-phasing, re-schedule, and logistics issues because they were all bedded more in the design phase.

According to C1, IPD projects resulted in less claim rather than traditional project delivery approaches.

> *'The contractor understands what the risks and unknowns are, and they can plan the budget accordingly, which helps mitigate claims.'*

C1 indicated that he hadn't experienced many differences in closeout procedures. Additionally, he mentioned how IPD resulted in a reduction in the amount of change orders.

> *'The intent of the contract documents is known better by the contractor because they're involved in the design process. So they were able to procure the work more efficiently, which leads to fewer change orders.'*

O1 said that IPD results in reducing of punch list items, which makes closeout procedures easier. According to him, adopting a lean approach focuses efforts on right at the first time and therefore, quality and safety issues are reduced as a matter of course. He continued explaining:

> *'The integrated decision-making and contractual arrangements make it difficult for contractors or clients to present any form of retrospective claim. And less claims results in easier contract management.'*

O2 mentioned that there was less amount of punch list items in the IPD project, because the designers controlled the works at site every week, checking if the contractor was doing the works properly with required quality. He remarked that there were no claims during the project.

The last question to the contractor interviewee was the most critical issues or requirements that should be addressed to implement IPD in emerging countries. C1's

answer to these questions will shed light on the way of Turkish contracting companies on adopting IPD.

> '*It is definitely a behavioral and cultural matter, to be able to have mutual trust and respect to each other. There are always legal and contractual issues related to IPD. IPD contract is very open-ended in the beginning. The parties should define what the contract should say perfectly, which differs from most contracts written in at the boilerplate contract language. That is obviously a challenge if it's new to people that have never done it before.'*

The same question was asked to the owners. O1 answered that change in the work culture of team and qualified staff could be addressed as the most critical requirements for IPD implementation in emerging countries.

Participant O2 provided recommendations for the environments in which IPD hasn't been experienced yet. He mentioned that the uppermost problem regards establishing the contract form, its terms and conditions. In this concept, he stated that having a standard agreement form is essential and it shouldn't be subject to negotiating.

> *'For the countries intent to adopt IPD, their chamber of architects should generate a standard form of IPD contract. Instead of creating your own form, translating AIA's form could be a good start for emerging countries.'*

Question 8 for owners asked the most significant collaboration issues or requirements in IPD and how owners decide on which companies to choose as partners for IPD projects. O1's answer to this question may shed light on the owners that have no experience with IPD.

> *'Most contractors look at projects and grade them based on their opportunity. If it's a one-off client, then configuring an IPD based supply chain to deliver a project for them would require effort; contractors also often consider one-off clients as an exploitation opportunity. At the other end of the spectrum, an intelligent client with a program of work or multiple projects would be better suited to enticing the right type of contractor to support the delivery of a*

program. If they see a continuity of work, they get engaged. Client leadership, with the appropriate values and behaviors, is where projects fail or succeed in the world of IPD.'

In Question 9, the owners' opinions on teaming up with a designer or a contractor which they had no experience on working together due to the trust issues. O1 answered that as long as the selection process was based on the proper criteria, the contract performance expectations are set out at the start, and the contract has appropriate mechanisms are in place to incentivize the performance of all parties, then there should be no issue.

5 CONCLUSION AND RECOMMENDATIONS

Because it is extremely fragmented, segmented, and composed of different small specialized enterprises, the traditional supply chain in the construction industry lacks process integration (Briscoe and Dainty, 2005; Harper et al., 2016; Mignone et al., 2016; Papadonikolaki and Wamelink, 2017).

IPD is a new concept that emerged to address and resolve the problems related to traditional delivery methods. Previous research demonstrates that IPD is an effective strategy for optimizing construction planning and reducing waste, cost, time, and risk. Despite this, IPD implementation is still limited, mainly due to industry personnel's awareness and appreciation. While the construction industries in many developed countries are improving their practice using IPD to solve the problems caused by traditional methods, the Turkish construction industry is still unfamiliar with the IPD concept.

This study aimed to expand awareness of IPD in Turkey. In the second chapter, the development of IPD is summarized with the outputs of the literature review. Firstly, the traditional systems are briefly explained to allow an in-depth understanding of disadvantages, with the reasons for the need to change project delivery methods. The key principles, advantages, and barriers are expounded. Addressing the advantages and challenges of IPD practice is found o be critical to shed light on the professionals that are unfamiliar with the IPD concept.

In the third chapter, two case studies are generated with the data provided by the company which the author’s been working for. The author’s primary motivation for case studies is the belief that the outcomes of the case studies conducted in regard to this study will brace the professionals to adopt IPD in Turkey, where there is no IPD implementation.

Finally, in the fourth chapter, semi-structured interviews are conducted with the IPD experts from the U.S to gather real-life experiences on IPD implementation.

The main inferences of this study extracted from literature review, case studies and interviews are discussed with recommendations as follows:

Aligned with prior research, the outcomes of literature review and interviews demonstrate that IPD is an effective method for optimizing construction planning, reducing waste, cost, time, and risk. Analysis of the case studies shows that the projects delivered with IPD are successful in terms of schedule and cost, in line with the prior research. Findings of the case studies proved that the common problems of traditional delivery methods such as long delivery durations due to disputes and delays, adversarial relationships between designer and contractor, poor production, cost, and time overruns are not recorded on IPD projects.

The most frequent benefit from the interviewees' viewpoint is reducing project risks and better risk management. Higher productivity, share in project profit, reduction of information requests, and reduction of change orders are the following most frequent benefits. Comparing the traditional delivery methods, IPD is found to be more beneficial in terms of punch lists, claims, change orders, and closeout procedures by interviewees. Seeing that the inferences of the interviews are aligned with the literature findings is encouraging for future adoption of IPD in Turkey because no studies are found in Turkey, which builds on the experiences of real-life users of IPD.

According to the interview results, it is also supportive that IPD is not found a risky business compared to traditional methods by the interviewees. This outcome is promotive, especially for the owners who may have concerns about choosing IPD based on the belief that IPD has a business risk.

Case studies show that IPD is also beneficial with future opportunities due to IPD teams' long-term relationships. The case studies conducted in this study's scope are successive, letting the owner choose IPD for the next project with the same design company. The possibility of establishing good relationships with the IPD parties may play a role in breaking the prejudice on IPD.

IPD's key principles were listed with citations in the scope of this thesis. According to the aligned outcomes of literature review, case studies, and interviews, early involvement of the key participants is found to be the most significant factor

contributing to the compression of schedules. Early involvement of the key parties can be shown as the main reason for not recording the common problems of traditional methods such as long delivery durations due to change orders and delays, adversarial relationships between designer and contractor, poor production, schedule, and cost overruns. This indication is also encouraging based on the experiences corroborating the prior research. Expanding the awareness on the benefits of teaming up in early phases with this outcome may motivate the Turkish professionals to adopt IPD.

According to the literature, the main reasons for the lack of widespread adoption of IPD are uncertainty, high initial costs, contractual difficulties, and implementation complexity. While previous research has focused on these reasons, interview results demonstrate quite different. The most critical challenge addressed by the interviewees is selecting the right team. Building and sustaining a collaborative environment, lack of experience with IPD components, group decision-making, and identifying objectives and performance measures are the most following critical challenges the interview participants faced.

Barriers to IPD are categorized, which are seen in developing countries to point out the similarities with Turkey. Organizational barriers to IPD adoption in Turkey are mostly related to BIM use. The researchers conclude that it is widely believed that BIM use is the main prerequisite for IPD. BIM is found to be also a financial barrier with its high initial cost because it is believed that BIM is a prerequisite for IPD. Since developing systems for BIM use is seen as a financial obstacle by contractors, it is important to generate incentive programs to BIM use. Trade associations can establish collaborative work with software suppliers to offer some discount or additional free support for the first-time users of the required software. Additionally, future studies should examine how BIM supports IPD in practice. This would increase the awareness of IPD being implemented more effectively with BIM's advantages.

The potential legal barriers to IPD use are related to Turkey's procurement laws because the contractor is forced to be selected based on the lowest bid price. However, IPD is a method that the selection of the parties should be made based on the capabilities and qualifications. It is not in compliance with the current rules

because the criteria for selecting agencies in IPD are expected to be value-based rather than cost-based. Additionally, KIK (Kamu İhale Kurumu / Public Procurement Authority) forces the use of standard contract documents for public projects, which is not suitable for multi-party agreements. In this point of view, the legal framework for both the selection of bidders and the use of relational contract type is needed for IPD adoption in Turkey. The first step should be the creation of a new legal framework that allows for bidder selection based on value.

The public sector can be a pioneer to IPD use in the construction industry, like most other areas. As mentioned in part 2.3.6., DB is found easy to change IPD as the designer and contractor are appointed at the same early stage of a project which is compatible with the key principles of IPD. The short-term action can be focusing on examining IPD-ish projects through case studies to let Turkish professionals understand that IPD can also be used as a philosophy prior to using IPD as a delivery method. In this way, it can help professionals to change their mindsets on the collaborative working of each party. DB can be used as combined with IPD's philosophy, not deviating from the limitations of the current legal frame. In this way, IPD-ish projects would provide a smooth transition for the industry. To achieve this aim, the universities and trade associations should work collaboratively to train professionals on the IPD principles. Until a new legal framework is developed for IPD use in public projects, IPD principles could be embarked on to use IPD as a philosophy.

Professional organizations such as the AIA and AGC have been at the leading edge of IPD strategy or awareness in terms of establishing standards, publishing IPD principles and processes, and fostering discussions among their members on topics like successful IPD projects, obstacles to IPD, and so on. A similar picture should be seen in Turkey to increase awareness on IPD. First of all, IPD should be a topic of discussion in Turkey. Chamber of Architects of Turkey, Union of Chambers of Turkish Engineers and Architects, and Turkish Contractors Association should publish white papers, arrange meetings and discussions in the first place. These chambers also lead to translating the books published in other languages.

To widespread of IPD knowledge in Turkey, a focus group exercise can be conducted by the related trade associations. The use of focus groups to collect

"specific information about attitudes, opinions, and preferences of a selected set of participants" has been proven to be useful. A selected amount of experienced professionals who would have representation of all stakeholders in the AEC industry can be brought together to discuss the issues under various categories. It can also be a topic for academic research. However, trade associations can make it easier to fund this type of event, which requires substantial participation.

Since lack of knowledge is an organizational obstacle for Turkey, these recommended efforts could lead Turkish AEC professionals to have a deeper knowledge of the IPD concept to ease IPD adoption in Turkey.

Not having a standard contract for IPD use in Turkey is a critical obstacle in Turkey hindering the start of IPD. As a result, generating a relational contract form is essential. Standard contracts and procedures should be established with the collaboration of universities, trade associations, public and private sector professionals. AIA templates can be translated into Turkish to start and have a sample. Choosing a delivery method is the owners' decision in general. In this context, encouraging owners is critical to let IPD be adopted in the industry. Training programs should be organized to convince owners on the benefits of IPD use. Making the understanding of the weak points of traditional methods and IPD's offers to solve them is essential.

According to the prior research, there have been no barriers to adopting relational contracting like IPD for private construction projects. In this point, IPD use in the private sector could be braced. For this aim, it is again required to to conduct training on IPD and have standard contracts and procedures.

Turkish work culture is generally distant from collaboration. As explained by the owners in the interview, establishing mutual trust is one of the greatest challenges of IPD use. In this context, future works should address the behavioral principles of IPD to expand awareness of collaboration and teamwork. Training sessions could be helpful to break this mindset in the construction industry, especially on the contractors. With the behavioral requirements of IPD defined by future works, the trade associations should generate education programs on how to establish trust, team soul and collaboration.

REFERENCES

Aapaoja, A., Herrala, M., Pekuri, A., & Haapasalo, H. (2013). *'The characteristics of and cornerstones for creating integrated teams'*. International Journal of Managing Projects in Business, 6:4, pp 695-713

Abadi, A. S. (2015) '*Attitude of Turkish and Middle Eastern Architecture Engineering Construction (AEC) Industry Toward Integrated Project Delivery (IPD) System*', [M.S. - Master of Science]. Middle East Technical University

Abdirad, H. and Dossick, C.S. (2019), *'Restructuration of architectural practice in integrated project delivery (IPD): two case studies'*, Engineering, Construction and Architectural Management, Vol. 26 No. 1, pp. 104-117.

AbouDargham, S., Bou Hatoum, M., Tohme, M., & Hamzeh, F. (2019). *'Implementation of Integrated Project Delivery in Lebanon: Overcoming the Challenges'*. In Proceedings of the 27th Annual Conference of the International. Group for Lean Construction, Dublin, Ireland (pp. 1-9).

Ademci, E. and Gundes, S. (2020) *'Individual and Organizational Level Drivers and Barriers to Building Information Modelling',* 26(1):89–109. https://doi.org/10.21315/ jcdc2021.26.1.5.

AIA. (2007a) *'Integrated Project Delivery: A Working Definition'*. America Institute of Architects (AIA).

AIA. (2007b) *'Integrated Project Delivery: A Guide'*. America Institute of Architects (AIA).

AIA. (2010) *'Integrated Project Delivery for Public and Private Owners*'. America Institute of Architects (AIA).

AIA, (2010). *'Integrated Project Delivery: Case Studies'*, America Institute of Architects (AIA).

AIA , (2014), *'An Updated working definition'* , America Institute of Architects (AIA).

Amirarjmandi, A., Eghtedari, M., & Mazaheri, T. (2011). *'Investigations about IPD and comparison with existing contractual methods'*. University of Semnan. Semnan- Iran: University of Semnan.

Anderson, R. (2010). *'An introduction to the IPD workflow for vector works BIM users'*. Nemetschek, Vectorworks.

Alinezhad, M., Saghatforoush, E., Kahvandi, Z., & Preece, C. (2020). *'Analysis of the Benefits of Implementation of IPD for Construction Project Stakeholders'*. Civil Engineering Journal, 6(8), 1609-1621.

Alves, T. and Shah, N., (2018). *'Analysis of Construction Contracts: Searching for Collaboration'*. Construction Research Congress 2018

Ashcraft, H. W. (2011) *'IPD Teams : Creation , Organization and Management'*. Hanson Bridgett, IPD/BIM, Retrieved December, 12, 2012.

Ashcraft Jr, H. W. (2014). *The transformation of project delivery*. Constr. Law., 34, 35.

Autodesk, (2008). *'Improving Building Industry Results through Integrated Project Delivery and Building Information Modeling'*, Autodesk White Paper, Autodesk Building Solutions, San Rafael.

El Asmar, M., Hanna, A. S. and Loh, W. Y. (2013) *'Quantifying performance for the integrated project delivery system as compared to established delivery systems'*, Journal of Construction Engineering and Management, 139(11), pp. 1–14. doi: 10.1061/(ASCE)CO.1943-7862.0000744.

Atkinson, A.R. and Westall, R. (2010), *'The relationship between integrated design and construction and safety on construction projects'*, Construction Management and Economics, Vol. 28 No. 9, pp. 1007-1017, doi: 10.1080/01446193.2010.504214.

Azhar, N., Kang, Y. and Ahmad, I. U. (2014) 'Factors influencing integrated project delivery in publicly owned construction projects: An information modelling perspective', *Procedia Engineering*, 77, pp. 213–221. doi: 10.1016/j.proeng.2014.07.019.

Bahçeci, H., & Polat, Ö. Ü. H. (2020). *'İnşaat Sektöründe Yüklenici Firma Ölçeğine Göre BIM Kullanımının Araştırılması'*. Online Journal of Art and Design, 8(2).

Baiden, B. K., & Price, A. D. (2011). *'The effect of integration on project delivery team effectiveness'*. International Journal of Project Management, 29(2), 129-136.

Baiden, B. K., Price, A., & Dainty, A. (2003). *'Looking beyond process: human factors in team integration'*.

Barker, J.A. (1993). *'Paradigms: the business of discovering the future'*. Harper Business, New York, NY

Bilbo, D., Bigelow, B., Escamilla, E., & Lockwood, C. (2015). *'Comparison of construction manager at risk and integrated project delivery performance on healthcare projects: A comparative case study'.* International Journal of Construction Education and Research, 11(1), 40-53.

Bilge, E. Ç., (2020) *'Information management in real estate development project lifecycle: BIM & IPD framework'.* [M.S. - Master of Science]. Istanbul Technical University.

Blayse, A. M., & Manley, K. (2004). *'Key influences on construction innovation'*. Construction innovation.

Briscoe, G., & Dainty, A. (2005). *'Construction supply chain integration: an elusive goal?'* Supply Chain Management: An International Journal, 10(4), 319–326.

Brochner, J. & Badenfelt, U. (2011). *'Changes and change management in construction and IT projects'*. Automation in Construction. 20 (7), 767-775

Carpenter, N. (2014). *'Comparison of the design-bid-build and construction manager at risk project delivery methods utilized for the construction of public schools'* Doctoral dissertation, Clemson University.

Chen, H. M., & Tien, H. C. (2007). *'Application of peer-to-peer network for real-time online collaborative computer-aided design'*. Journal of Computing in Civil Engineering, 21(2), 112-121.

Chinowsky, P. S., Diekmann, J., & O'Brien, J. (2010). *'Project organizations as social networks'*. Journal of construction engineering and management, 136(4), 452-458.

Cho, S., Ballard, G., Azari, R., and Kim, Y. (2010). *'Structuring ideal project delivery system'*. Proc., IPPC4, 2010.

Civitello, A.M. (2000). *'Construction Operations Manual of Policies and Procedures'*. USA: McGraw-Hill.

Cohen J. (2010). *'Integrated project delivery: case studies'*. Sacramento (CA): The American Institute of Architects California Council.

Collins, W. and Parrish, K. (2014). *'The Need for Integrated Project Delivery in the Public Sector'*. Construction Research Congress, 719-728.

Çileli, E. (2020) *'Türkiye'de BIM tabanli yapim projelerinin tasarim süreçlerinin ipd ile ilişkilendirilmesi analizi ve proje süreç matrisine adaptasyonu'*. [M.S. - Master of Science]. Istanbul Technical University.

DeBernard, D. M., (2008). *'Beyond collaboration-The Benefits of Integrated Project Delivery'*. http://soloso.aia.org/eKnowledge/Resources/Documents/AIAP037286

De Marco, A. and Karzouna, A. (2018) 'Assessing the benefits of the integrated project delivery method: A survey of expert opinions', *Procedia Computer Science*, 138, pp. 823–828. doi: 10.1016/j.procs.2018.10.107.

Department of Commerce, (2004), *'2002 economic census: Table 1. Advance summary statistics for the United States'* Bureau of Economic Analysis website, http://www.census.gov/econ/census02/advance/ TABLE1.HTML（Jun. 11, 2009）

Dilsizoğlu Özperçin, G. (2016) *'Integrated Project Delivery Method Using Bim To Support of Sustainable Design and Construction'*, [M.S. - Master of Science]. Yildiz Technical University.

Durdyev, S., Ihtiyar, A., Banaitis, A. and Thurnell, D. (2018), *'The construction client satisfaction model: a PLS-SEM approach'*, Journal of Civil Engineering and Management, Vol. 24 No. 1, pp. 31-42.

Durdyev, S. & Hosseini, M.R. (2019), *'Causes of delays on construction projects: a comprehensive list'*, International Journal of Managing Projects in Business (forthcoming), available at: https:// doi.org/10.1108/IJMPB-09-2018-0178

Durdyev, S., Hosseini, M. R., Martek, I., Ismail, S., & Arashpour, M. (2019). *'Barriers to the use of integrated project delivery (IPD): a quantified model for Malaysia'*. Engineering, Construction and Architectural Management.

Durdyev, S. and Mbachu, J. (2011), *'On-site labour productivity of New Zealand construction industry: key constraints and improvement measures'*, Construction Economics and Building, Vol. 11 No. 3, pp. 18-33.

Elghaish, F., Abrishami, S., Hosseini, M. R., Abu-Samra, S., & Gaterell, M. (2019). *'Integrated project delivery with BIM: An automated EVM-based approach'*. Automation in Construction, 106, 102907.

Emiliani, M. L. (2008). *'The Equally Important 'Respect for People' Principle'*. Real Lean: The Keys to Sustaining Lean Management (Volume Three), M. L. Emiliani, ed., The CLBM, LLC, Wethersfield, Conn., USA.

Fernando, C.K., Hosseini, M.R., Zavadskas, E.K., Perera, B. & Rameezdeen, R. (2017), *'Managing the financial risks affecting construction contractors: implementing hedging in Sri Lanka'*. International Journal of Strategic Property Management, Vol. 21 No. 2, pp. 212-224.

Fischer, M., A. Khanzode, D. Reed, and H. W. Ashcraft. (2017). *'Integrating project delivery'*. Hoboken, NJ: Wiley.

FMI/CMAA (FMI and Construction Managers Association of America), (2005). *'Sixth annual survey of owners'*. Retrieved from www.cmaanet.org

Forbes, L. H., & Ahmed, S. M. (2010). *'Modern construction: lean project delivery and integrated practices'*. CRC press.

Francom, T. C. (2015). *'Performance of the construction manager at risk (CMAR) delivery method applied to pipeline construction projects'*. Arizona State University

Franz, B., Leicht, R., Molenaar, K., & Messner, J. (2017). *'Impact of team integration and group cohesion on project delivery performance'*. Journal of construction engineering and management, 143(1), 04016088.

Gallaher, M. P., O'Connor, A. C., Dettbarn, J. L., and Gilday, L. T. (2004). '*Cost analysis of inadequate interoperability in the U.S. capital facilities industry*', National Institute of Standards and Technology, www.bfrl.nist.gov/oae/publications/gcrs/04867.pdf (Jun. 11, 2009)

Ghassemi, R. and Becerik-Gerber, B. (2011), *'Transitioning to Integrated Project Delivery: Potential Barriers and Lessons Learned'*, Lean Construction Journal, pp. 32-52.

Ghoddousi, P. & Hosseini, M.R. (2012), *'A survey of the factors affecting the productivity of construction projects in Iran'*, Technological and Economic Development of Economy, Vol. 18 No. 1, pp. 99-116.

Gomez, S., Ballard, G., Naderpajouh, N., & Ruiz, S. (2018). *'Integrated Project Delivery for Infrastructure Projects in Peru'*. In 26th Annual Conference of the International. Group for Lean Construction (pp. 452-462).

Gordon, C. M. (1994). *'Choosing Appropriate Construction Contracting Method'*. Journal of Construction Engineering Management, 187(3), 56-69.

Hale, D. R., Shrestha, P. P., Gibson Jr, G. E., & Migliaccio, G. C. (2009). *'Empirical comparison of design/build and design/bid/build project delivery methods'*. Journal of construction engineering and management, 135(7), 579-587.

Hall, D. and Scott, W., (2019). *'Early Stages in the Institutionalization of Integrated Project Delivery'*. Project Management Journal, 50(2), pp.128-143.

Hamzeh, F., Rached, F., Hraoui, Y., Karam, A. J., Malaeb, Z., El Asmar, M., & Abbas, Y. (2019). *'Integrated project delivery as an enabler for collaboration: a Middle East perspective'*. Built Environment Project and Asset Management.

Harper, C. M., Molenaar, K. R., & Cannon, J. P. (2016). *'Measuring constructs of relational contracting in construction projects: The owner's perspective'*. Journal of Construction Engineering and Management, 142(10), 04016053.

Hellmund, A. J., Van Den Wymelenberg, K. G., & Baker, K. (2008). *'Facing the challenges of integrated design and project delivery'*. Energy engineering, 105(6), 36-47.

Holmen, E., Pedersen, A.-C. and Torvatn, T. (2005) *'Building relationships for technological innovation'*. Journal of Business Research, 58(9), 1240–50

H**owell, I.** (1996) *'The need for interoperability in the construction industry'*. In:, International Construction Information Technology Conference, April, 1996., 43-7.

Hosseini, M.R., Banihashemi, S., Martek, I., Golizadeh, H. & Ghodoosi, F. (2018), *'Sustainable delivery of megaprojects in iran: integrated model of contextual factors'.* Journal of Management in Engineering, Vol. 34 No. 2, pp. 1-12, doi: 10.1061/(ASCE)ME.1943-5479.0000587.

Jackson, B.J., (2011). *'Design–Build Essentials'*, Delmar, Cengage Learning, New York, USA.

Jaafari, A. & Manivong, K. (1999) *'The need for life-cycle integration of project processes'*. Engineering Construction and Architectural Management, 6(3), 235-55.

Kahvandi, Z., Saghatforoush, E., Alinezhad, M., & Noghli, F. (2017). *'Integrated Project Delivery (IPD) Research Trends'*. Journal of Engineering, Project, and Production Management, 7(2), 99.

Kahvandi, Z., Saghatforoush, E., ZareRavasan, A., & Preece, C. (2019). '*Integrated project delivery implementation challenges in the construction industry'*. Civil Engineering Journal, 5(8), 1672-1683.

Kahvandi, Z., Saghatforoush, E., ZareRavasan, A., & Viana, M. L. (2020). *'A Review and Classification of Integrated Project Delivery Implementation Enablers'*. Journal of Construction in Developing Countries, 25(2), 219-236.

Kahvandi, Z., Saghatforoush, E., Mahoud, M., & Preece, C. (2019). *'Analysis of the barriers to the implementation of integrated project delivery (IPD): A meta-synthesis approach'*. Journal of Engineering, Project, and Production Management, 9(1), 2-11.

Kallio, H., Pietilä, A. M., Johnson, M., & Kangasniemi, M. (2016). *'Systematic methodological review: developing a framework for a qualitative semi-structured interview guide'*. Journal of advanced nursing, 72(12), 2954-2965.

Kazaz, A., Er, B. and Ulubeyli, S. (2012) 'Applicability of integrated project delivery system to public construction projects in Turkey', *Creative Construction*

Conference (CCC2012), (October 2015).

Kenig, M.E., (2011). *'Project Delivery Systems for Construction'*. The Associated General Contractors of America, Arlington.

Kent, D. and Becerik-Gerber, B., (2010). *'Understanding Construction Industry Experience and Attitudes toward Integrated Project Delivery'*. Journal of Construction Engineering and Management, 136(8), pp.815-825.

Kelly S.E. (2010) '*Qualitative interviewing techniques and styles*'. In The SAGE Handbook of Qualitative Methods in Health Research (Bourgeault I., Dingwall R. & De Vries R., eds), SAGE, London, pp. 307–327.

Kiani, I. & Khalili Ghomi, S. (2013). *'The Barriers and Implementation of Building Information Modeling (BIM) based on Integrated Project Delivery (IPD) In the Construction Industry'*. Author Profiles for This Publication at: https://www.researchgate.net/publication/272789025.

Kibert, C.J. (2016), *'Sustainable Construction: Green Building Design and Delivery'*, John Wiley & Sons, Hoboken, NJ.

Korb, I., Haronian, E., Sacks, R., Judez Muñoz, P., & Shaked, O. (2016). *'Overcoming "But We're Different": an IPD implementation in the Middle East',* In Proceedings 24th Annual Conference of the International Group for Lean Construction, Boston, MA, USA, sect. 7 (pp. 3-12).

K**umaraswamy, M., Ling, F., Rahman, M., & Phng, S.** (2005). *'Constructing relationally integrated teams'*. J. Constr. Eng. Manage., 10.1061/(ASCE)0733-9364(2005)131:10(1076), 1076–1086.

Lahdenperä, P. (2012). *'Making sense of the multi-party contractual arrangements of project partnering, project alliancing and integrated project delivery'*. Construction management and economics, 30(1), 57-79.

Lichtig, WA. (2006) *'Integrated Agreement for Lean Project Delivery'*, The Construction Law. 26:25.

Ma, J., Ma, Z., & Li, J. (2017). *'An IPD-based incentive mechanism to eliminate change orders in construction projects in China'*. KSCE Journal of Civil Engineering, 21(7), 2538-2550.

Ma, Z., Zhang, D. and Li, J. (2018), *'A dedicated collaboration platform for integrated project delivery'*, Automation in Construction, Vol. 86, February, pp. 199-209, doi: 10.1016/j.autcon.2017.10.024.

Matthews, O. and Howell, G.A., (2005). *'Integrated project delivery an example of relational contracting'*. Lean construction journal, 2 (1), 46–61.

Mesa, H. A., Molenaar, K. R., & Alarcón, L. F. (2016). *'Exploring performance of the integrated project delivery process on complex building projects'*. International Journal of Project Management, 34(7), 1089-1101.

Mignone, G., Hosseini, M.R., Chileshe, N. and Arashpour, M. (2016), *'Enhancing collaboration in BIM- based construction networks through organisational discontinuity theory: a case study of the new royal Adelaide hospital'*, Architectural Engineering and Design Management, Vol. 12 No. 5, pp. 333-352, doi: 10.1080/17452007.2016.1169987.

Mihic, M., Sertic, J., & Zavrski, I. (2014). *'Integrated project delivery as integration between solution development and solution implementation'*. Procedia-social and behavioral sciences, 119, 557-565.

Mohd Nawi, M. N., Haron, A. T., Abd Hamid, Z., Mohamad Kamar, K. A., & Baharuddin, Y. (2014). *'Improving integrated practice through building information modeling-integrated project delivery (BIM-IPD) for Malaysian Industrialised Building System (IBS) Construction Projects'*. Malaysian Construction Research Journal, 15(2), 1-15.

Molenaar, K. R., Songer, A. D., & Barash, M. (1999). *'Public-sector design/build evolution and performance'.* Journal of management in engineering, 15(2), 54-62.

Mossman, A., Ballard, G., & Pasquire, C. (2010). *'Lean Project Delivery-innovation in integrated design & delivery'*. Architectural Engineering and Design Management, 1-28.

Munakami, M. (2012). *'Development and Testing of Simulation (Game) to Illustrate Basic Principles of Integrated Project Delivery and Building Information Modeling'*. Texas: Texas A&M University

Nanda, U., K. Rybkowski, Z., Pati, S., & Nejati, A. (2017). *'A value analysis of lean processes in target value design and integrated project delivery: Stakeholder perception'.* HERD: Health Environments Research & Design Journal, 10(3), 99-115.

Noble, C., 2007. *'Can project alliancing agreements change the way we build?'* http://www.architecturalrecord.com/articles/6956-can-project-alliancing-agreements-change-the-way-we-build

O'Connor, P. (2009). *'Integrated project delivery: Collaboration through new contract forms'*. Faegre & Benson, 23.

Osman, W. N., Nawi, M. N. M., Zulhumadi, F., Shafie, M. W. M., & Ibrahim, F. A. (2017). *'Individual readiness of construction stakeholders to implement integrated project delivery (IPD)'*. Journal of Engineering Science and Technology, 12(2), 229-238.

Papadonikolaki, E. and Wamelink, H. (2017), *'Inter- and intra-organizational conditions for supply chain integration with BIM'*, Building Research & Information, Vol. 45 No. 6, pp. 649-664, doi: 10.1080/09613218.2017.1301718.

Pishdad-Bozorgi, P. (2017). *'Case studies on the role of integrated project delivery (IPD) approach on the establishment and promotion of trust'*. International Journal of Construction Education and Research, 13(2), 102-124.

Pishdad-Bozorgi, P., & Beliveau, Y. J. (2016). *'Symbiotic relationships between integrated project delivery (IPD) and trust'*. International Journal of Construction Education and Research, 12(3), 179-192.

Perlberg, B. (2009). *'Contracting for integrated project delivery: Consensus docs'*. The 48th Annual Meeting of Invited Attorneys, Victor O. Schinnerer and Company, Inc.

Piroozfar, P., Farr, E. R., Zadeh, A. H., Inacio, S. T., Kilgallon, S., & Jin, R. (2019). *'Facilitating building information modelling (BIM) using integrated project delivery (IPD): A UK perspective'*. Journal of Building Engineering, 26, 100907.

Rached, F., Hraoui, Y., Karam, A., & Hamzeh, F. (2014). *'Implementation of IPD in the Middle East and its Challenges'.* In 22nd annual conference of the international group for Lean construction (Vol. 6, No. 25, p. 2014). Oslo, Norway.

Rahim S. A. (2015) Unpublished Master Thesis UUM

Rahim, S. A., Nawi, M. N. M., and Nifa, F. A. A. (2015). *'Improving Construction Industry through Integrated Project Delivery (IPD)'*. BinaTECH, 1, 27-32.

Rahim, S., Mohd Nawi, M. and Nifa, F., (2016). *'Integrated Project Delivery (IPD): A Collaborative Approach to Improve the Construction Industry'*. Advanced Science Letters, 22(5), pp.1331-1335

Roundtable, C. U. (2004). *'Collaboration, integrated information and the project lifecycle in building design, construction and operation'*. Construction Users Roundtable (CURT), Cincinnati, OH.

Roy, D., Malsane, S. and Samanta, P. K. (2018) 'Identification of critical challenges for adoption of integrated project delivery', *Lean Construction Journal*, 2018(March), pp. 1–15.

Rutten, M., Dore´e, A. and Halman, J. (2009) *'Innovation and interorganizational cooperation: a synthesis of literature'*. Construction Innovation, 9(3), 285–97.

RWJF (Robert Wood Johnson Foundation) (2008) *'Semi-structured Interviews'*. Retrieved from http://www.qualres.org/HomeSemi3629.html on 16 April 2015

Sanvido, V., & Konchar, M. (1999). *'Selecting project delivery systems: Comparing design-bid-build, design-build, and construction management at risk'*. State College, PA: Project Delivery Institute

Sive, T., & Hays, M. (2009). *'Integrated project delivery: Reality and promise, a strategist's guide to understanding and marketing IPD*'. Society for Marketing Professional Services Foundation.

Sommer, A. F., Dukovska-Popovska, I., & Steger-Jensen, K. (2014). *'Barriers towards integrated product development-Challenges from a holistic project management perspective'*. International Journal of Project Management, 32(6), 970-982.

Slaughter, E.S. (1998), *'Models of construction innovation'*, Journal of Construction Engineering and Management, Vol. 124 No. 3, pp. 226-231, doi: 10.1061/(ASCE)0733-9364(1998)124:3(226).

Sullivan, J., Asmar, M. E., Chalhoub, J., & Obeid, H. (2017). *'Two decades of performance comparisons for design-build, construction manager at risk, and design-bid-build: Quantitative analysis of the state of knowledge on project cost, schedule, and quality'*. Journal of construction engineering and management, 143(6), 04017009.

Tan, S. (2021) *'Türk inşaat sektöründe bim uygulamalarinin yaygin kullanilmamasina neden olan faktörlerin belirlenmesi'* [M.S. - Master of Science]. Hasan Kalyoncu University.

Taylor, G. R. (Ed.). (2005). *'Integrating quantitative and qualitative methods in research'*. University press of America.

Thomsen, C., Darrington, J., Dunne, D., & Lichtig, W. (2010). *'Managing integrated project delivery*'. McLean, VA: Construction Management Association of America.

Townes, A., Franz, B. W., & Leicht, R. M. (2015). *'A case study of IPD team selection'*. Paper presented at the Engineering Project Organization Conference. Scotland, UK.

Viana, M. L., Hadikusumo, B. H., Mohammad, M. Z., & Kahvandi, Z. (2020). *'Integrated Project Delivery (IPD): An Updated Review and Analysis Case Study'*. Journal of Engineering, Project & Production Management, 10(2).

Vincent, S. & Kirkpatrick, S. W. (1995) *'Integrating different views of integration'*. In P. Brandon and M. Betts, (eds) Integrated construction information, 1st Edition, London: E& FN Spon.

Ward, J. & Holman, D. (2001). *'Who needs a plan?'* In C. Berglund (Ed.), Health research. Melbourne: Oxford University Press.

Watson, T. (2001) *'Introduction of a Target Cost Mechanism in One of the LHC Civil Engineering Contracts: Accelerators and Storage Rings'*, CERN, Chamonix, pp. 191-196.

WEF. (2016). *'Shaping the Future of Construction: A Breakthrough in Mindset and Technology'*. Geneva, Switzerland: World Economic Forum.

Wilkinson, P. (2012), *'FIDIC – behind the times when it comes to collaboration?'*, Extranet Evolution, available at: http://extranetevolution.com/2012/07/fidic-behind-the-times-when-it-comes-to- collaboration/ (accessed February 1, 2019).

Williams, T., 1999. '*The need for new paradigms for complex projects'*. International Journal of Project Management, 17(5), pp.269-273.

Woods, M. (2011). 'Interviewing for research and analyzing qualitative data: An overview'. Massey University, 67-80.

Wrigley, M. (2002) *'Review: Tom Wengraf (2001). Qualitative Research Interviewing: Biographic Narrative and Semi-Structured Method'*, Forum Qualitative Sozialforschung / Forum: Qualitative Social Research, 3(4). doi: 10.17169/fqs-3.4.801.

Xie, H., & Liu, H. (2017). *'Studying contract provisions of shared responsibilities for integrated project delivery under national and international standard forms'*. Journal of Legal Affairs and Dispute Resolution in Engineering and Construction, 9(3), 04517009.

Yee, L. S., Saar, C. C., Yusof, A. M., Chuing, L. S., & Chong, H. Y. (2017). *'An empirical review of integrated project delivery (IPD) System'*. International Journal of Innovation, Management and Technology, 8(1), 1-8.

Yu, J. H., Yoo, S. E., Kim, J. I., & Kim, T. W. (2019). *'Exploring the factor-performance relationship of integrated project delivery projects: A qualitative comparative analysis'*. Project Management Journal, 50(3), 335-345.

Yue, T., Xiao, L., Peng, W. & Xiangyu, W. (2017): *'Using cooperative game theory to determine profit distribution in IPD projects'*. International Journal of Construction Management, doi: 10.1080/15623599.2017.1358075

Zhang, L., & Li, F. (2014). *'Risk/reward compensation model for integrated project delivery'*. Engineering Economics, 25(5), 558-567.

Zhang, L., Huang, S. and Peng, Y. (2018), *'Collaboration in integrated project delivery: the effects of trust and formal contracts'*, Engineering Management Journal, Vol. 30 No. 4, pp. 262-273, doi: 10.1080/10429247.2018.1498259.

APPENDICES

Interview

Form

Dear Professionals,

I am currently pursuing my MSc Degree in Construction Project Management at Mimar Sinan Fine Arts University (MSFAU). My master thesis focuses on driving factors and potential obstacles to Integrated Project Delivery transformation in Turkey. I am therefore reaching out to ask if you, as professionals experienced in IPD, would be available for an interview in order to ask some of the questions attached below and to discuss IPD's competitiveness further.

The interview should take no more than 30 minutes and we can conduct it over Teams, Skype or a conference call. Please let me know if you have any availability in the weeks coming up.

Additionally, please do let me know if you demand for your personal information not to be included in the research paper and further publications.

I appreciate your time and contribution to my research. I would be grateful if you can also circulate this call for the interview among your colleagues and experts.

Begum Karamanoglu

Architect / MSc Student

Interview Questions

General Information:

1. What is your role in the construction industry?
   - ☐Owner
   - ☐Developer
   - ☐Architect
   - ☐Engineer/
   - ☐Subcontractor
   - ☐General Contractor
   - ☐Supplier
   - ☐Consultant

2. How many years have you been working in the AEC industry?

3. Which of the following project delivery methods do you have experience with?
   - ☐Design-Build
   - ☐Design-Bid-Build
   - ☐Build-Operate-Transfer
   - ☐Construction Manager at Risk
   - ☐Integrated Project Delivery

4. How many projects have you delivered using IPD? Please also indicate project types and how long have you been working with IPD awarded projects.

Questions to Owner Interviewees

1) How did you decide to use IPD for your projects?
   - ☐In terms of recommendations by peers or consultants
   - ☐White papers' promotion on IPD
   - ☐Having a limited budget
   - ☐Speed of delivery
   - ☐To mitigate project risks
   - ☐To maximize project value
   - ☐Project complexity
   - ☐To gain market advantage
   - ☐Other

2) Which (of the following) factors are considered when making the decision to adopt IPD in your projects?
   - ☐Project size
   - ☐ Project type
   - ☐ Complexity
   - ☐ Budget
   - ☐ Schedule

3) Please indicate the parties integrated into the IPD project you've experienced
   - ☐Owner, designer, contractor
   - ☐Owner, designer, contractor, suppliers
   - ☐Owner, designer, contractor, consultant
   - ☐Owner, designer, contractor, suppliers, and building operator
   - ☐Owner, designer, contractor and building operator

4) What benefits have you accrued through IPD use for your projects? Which is the most significant?
   - ☐Deciding and defining general goals
   - ☐Building long-term relations between stakeholders
   - ☐Possibility of using participatory and integrated software
   - ☐High motivation of team members because of share in profit and loss
   - ☐Reducing project risks and better risk management
   - ☐Reducing project complexities due to single contracts
   - ☐Higher productivity
   - ☐Change reduction
   - ☐Projects with higher quality
   - ☐Better project in terms of sustainability

☐Reducing mistakes due to single person decisions
☐Reducing construction time due to more compressed planning
☐Increase of project value comparing traditional contracts
☐Reducing operation and maintenance costs
☐Better control of project costs
☐Earlier project operation
☐Integrated leadership
☐Reduction of waste of resources
☐Reduction of claims and disputes
☐Better resolving the problems

5) What are the challenges faced in the design and implementation IPD projects?
☐Building and sustaining a collaborative environment
☐Selecting the right team
☐Trades' and consultants' reluctance to participate in IPD
☐Establishing mutual respect and trust.
☐Documenting and tracking information
☐Changing team members along the project
☐Lack of experience with IPD components
☐Group decision-making
☐Identifying objectives and performance measures
☐Overshadowing designers
☐Cost and schedule reduction as key targets
☐Focus on 1st cost, not life cycle cost

6) Given these benefits and challenges, what would be the main reasons for selecting and not selecting IPD for your projects?

7) Can you compare the IPD projects and traditionally delivered projects in terms of;
☐Punch lists --->
☐Claims --->
☐Closeout procedures --->
☐Contract management --->

8) Based on your experience, what are the most significant collaboration issues/requirements in IPD? How do you decide on which companies you will be partners with for IPD projects?

9) What do you think about signing an IPD contract with a designer or a contractor due to the trust issues of IPD? Would you be/have you been partners with a designer/contractor you have not worked with before?

10) What do you think about signing an IPD contract with a designer or a contractor due to the trust issues of IPD? Would you/have you be partners with a designer/contractor you have not worked with before?

11) In your opinion, is there any business risk on IPD use? Please give a brief explanation

12) In your opinion, what are the most critical issues/requirements that should be addressed for the implementation of IPD in emerging countries? What would be your recommendations for overcoming given obstacles?
☐Tender awarding mechanisms for public projects
☐Selecting compensation and incentive structure
☐High initial costs
☐Contractual hardships
☐Unclear responsibility of each of parties
☐The complexity of IPD insurance contracts
Selecting the app
☐Change in the work culture of team
☐Technological sufficiency
☐BIM adoption
☐Financial sufficiency in terms of shared risks
☐Qualified staff
☐Unwillingness to change and tend to use traditional systems

Questions to Contractor Interviewees

1) How did you decide your company was ready to IPD? What were the tools and metrics for assessing the readiness of your organization for IPD implementation?
☐Financial sufficiency
☐Technology
☐BIM skills
☐Understanding of IPD concept

2) Which (of the following) factors are considered when deciding to involve in an IPD project?
☐Project size
☐ Project type
☐ Complexity
☐ Budget
☐ Schedule
☐Other--->

3) Please indicate the parties integrated into the IPD project you've experienced
☐Owner, designer, contractor
☐Owner, designer, contractor, suppliers
☐Owner, designer, contractor, consultant
☐Owner, designer, contractor, suppliers, and building operator

☐Owner, designer, contractor and building operator

4) What benefits have you accrued through IPD use for your projects? Which is the most significant?
☐Deciding and defining general goals
☐Building long-term relations between stakeholders
☐Possibility of using participatory and integrated software
☐High motivation of team members because of share in profit and loss
☐Reducing project risks and better risk management
☐Reducing project complexities due to single contracts
☐Higher productivity
☐Change reduction and less rework
☐Reduction of problems related to construction in design phase
☐Reduction of construction time due to more compressed planning and result in reduction of overhead costs
☐Possibility of more accurate planning
☐High quality of construction and reduction of warranty period cost
☐More accurate control of project costs
☐Share in project profit
☐Reduction of troubleshooting and warranty period costs
☐Better understanding of designs in design phase
☐Reduction of waste of resources
☐Reduction of claims and disputes
☐Better resolving the problems
☐Reduction of information request
☐Reduction of change orders

5) What are the challenges faced in the design and implementation IPD projects?
☐Building and sustaining a collaborative environment
☐Establishing mutual respect and trust.
☐Documenting and tracking information
☐Changing team members along the project
☐Lack of experience with IPD components
☐Group decision-making
☐Identifying objectives and performance measures
☐Overshadowing designers
☐Cost and schedule reduction as key targets
☐Focus on 1st cost, not life cycle cost
☐Other--->

6) Can you compare the IPD projects and traditionally delivered projects in terms of;
☐Punch lists --->
☐Claims --->
☐Closeout procedures --->
☐Contract management --->

7) In your opinion, is there any business risk on IPD use? Please give a brief explanation

8) Is there any training on IPD for your employees?
   ☐Communication procedures
   ☐Information sharing
   ☐Collaborative working
   ☐Trust environment
   ☐BIM
   ☐Other--->

9) As a contractor, what is the most significant advantage of IPD?

   ☐Shared savings
   ☐Less rework
   ☐Short schedule
   ☐Less NCR
   ☐ Other--->

10) In your opinion, what are the most critical issues/requirements that should be addressed for the implementation of IPD in emerging countries? What would be your recommendations for overcoming given obstacles?
   ☐Legal (tender awarding mechanisms for public projects, financing,etc.)
   ☐Contractual
   ☐Behavioral/cultural (owner attitudes etc.)
   ☐Technological (use of BIM etc.)

Questions to Designer Interviewees

1) How did you decide your company was ready to IPD? What were the tools and metrics for assessing the readiness of your organization for IPD implementation?
   ☐Financial sufficiency
   ☐Technology
   ☐BIM skills
   ☐Understanding of IPD concept
   ☐Other--->

2) Which (of the following) factors are considered when deciding to involve in an IPD project?
   ☐Project size
   ☐ Project type
   ☐ Complexity
   ☐ Budget
   ☐ Schedule
   ☐Other--->

3) Please indicate the parties integrated into the IPD project you've experienced
   - ☐Owner, designer, contractor
   - ☐Owner, designer, contractor, suppliers
   - ☐Owner, designer, contractor, consultant
   - ☐Owner, designer, contractor, suppliers, and building operator
   - ☐Owner, designer, contractor and building operator

4) What benefits have you accrued through IPD use for your projects? Which is the most significant?
   - ☐Deciding and defining general goals
   - ☐Building long-term relations between stakeholders
   - ☐Possibility of using participatory and integrated software
   - ☐High motivation of team members because of share in profit and loss
   - ☐Reducing project risks and better risk management
   - ☐Reducing project complexities due to single contracts
   - ☐Higher productivity
   - ☐Change reduction
   - ☐More accurate designing with fewer problems
   - ☐Designing based on client needs
   - ☐Accuracy in extracting client needs
   - ☐Reduction of documentary generating time due to participation
   - ☐Increased quality of design
   - ☐Share in project profit
   - ☐Reduction of information request
   - ☐Reduction of change orders

5) What are the challenges faced in the design and implementation IPD projects?
   - ☐Building and sustaining a collaborative environment
   - ☐Establishing mutual respect and trust.
   - ☐Documenting and tracking information
   - ☐Changing team members along the project
   - ☐Lack of experience with IPD components
   - ☐Group decision-making
   - ☐Identifying objectives and performance measures
   - ☐Overshadowing designers
   - ☐Cost and schedule reduction as key targets
   - ☐Focus on 1st cost, not life cycle cost
   - ☐Other--->

6) What do you think about the owner's and the contractor's involvement in the design phase? Anything challenging? Any advantages?

7) In your opinion, is there any business risk on IPD use? Please give a brief explanation

8) Is there any training on IPD for your employees?
   ☐Communication procedures
   ☐Information sharing
   ☐Collaborative working
   ☐Trust environment
   ☐BIM
   ☐Other--->

9) Is there any differences between your fees for an IPD project and the traditionally delivered projects in terms of risk-sharing?

10) What is the most significant advantage of IPD for a design company and why?
   ☐Performance
   ☐Quality
   ☐Less Rework
   ☐Schedule
   ☐Other--->