

ATTITUDE OF TURKISH AND MIDDLE EASTERN ARCHITECTURE
ENGINEERING CONSTRUCTION (AEC) INDUSTRY TOWARD INTEGRATED
PROJECT DELIVERY (IPD) SYSTEM

A THESIS SUBMITTED TO
THE GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES
OF
MIDDLE EAST TECHNICAL UNIVERSITY

BY
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IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR
THE DEGREE OF MASTER OF SCIENCE
IN
CIVIL ENGINEERING

AUGUST 2015

Approval of the thesis:

ATTITUDE OF TURKISH AND MIDDLE EASTERN ARCHITECTURE ENGINEERING
CONSTRUCTION (AEC) INDUSTRY TOWARD INTEGRATED PROJECT DELIVERY (IPD)
SYSTEM

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ABSTRACT

ATTITUDE OF TURKISH AND MIDDLE EASTERN ARCHITECTURE ENGINEERING CONSTRUCTION (AEC) INDUSTRY TOWARD INTEGRATED PROJECT DELIVERY (IPD) METHOD

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August 2015, 131 Pages

Some of the 21th century's controversial issues in construction industry are inability in completing the projects in schedule or budget, insufficient architectural drawings (according to the owners), inadequacy in decreasing the waste, tremendous energy consumption of buildings and inefficiency in controlling carbon emissions from buildings. Nonetheless, adversarial relationships between participants are a fatal factor in any project's success. Unfortunately, previous project delivery methods incapable of shedding light on these problems. Therefore, the Integrated Project Delivery system is developed in order to achieve a more suitable delivery system to overcome these issues. The system is introduced in order to decrease the adversarial relationship between parties, enable more collaboration of stakeholders, optimize the resources and material consumption and leverage the performance of labor in conjunction with taking recently emerged building information modeling technologies and lean construction principles as catalyst. Limited

applications of IPD have been seen worldwide and although increasingly adopted in the United States, its application in Turkey and the Middle East has not commenced yet.

There are some impediments to IPD's wide use such as risks in relations, the need for a new legal framework, difficulties in close partnership and need to new competencies and skills. In order to support embracing of IPD in Turkey and Middle East, a survey has been conducted by AEC industry professionals. Respondents consisted of experts and professionals whom are experienced or informed about Integrated Delivery Method and Building Information Modeling applications in construction projects. This study aims to investigate the attitude of AEC professionals toward IPD as well as to identify obstacles limiting the use of IPD. Moreover, the effect of BIM technology in promoting the development and implementation of IPD is investigated. The results show that industry has an interest and expect benefits from IPD. Almost 94% of all individuals eager to participate in IPD projects. According to our findings experts listed the main obstacles as fear of change, lack of IPD awareness and lack of appropriate legal structure for IPD. Therefore, some additional measures such as adequate introduction and promotion, whether by education system or true advertisement, appropriate legal regulations and supports should be taken to make use of IPD possible in Turkey and Middle East's AEC industry. Findings indicate that most professionals prognosticate that IPD will hold about 5~10 % of the market within 5 to 10 years.

Keywords: integrated project delivery – building information modeling – collaboration - feasibility studies – project alliancing - AEC industry

ÖZ

TÜRKİYE VE ORTA DOĞU İNŞAAT, MİMARLIK VE MÜHENDİSLİK SANAYİSİNİN TÜMLEŞİK PROJE TESLİM (TPT) SİSTEMİNE YAKLAŞIMI

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Yüksek Lisans, İnşaat Mühendisliği Bölümü

Tez Yöneticisi: Asst. Prof. Dr. Aslı Akçamete Güngör

Ağustos 2015, 131 Sayfa

İnşaat sektöründe 21. Yüzyılın en tartışmalı konularından bazıları, projelerin zamanında ve bütçesi içerisinde yapmaktaki başarısızlık, mimari çizimlerin yetersizliği (işverenlere göre), atıkların azaltımının yetersizliği, binaların çok yüksek enerji tüketimi ve binaların karbon salımlarını kontrol etmedeki verimsizlik.

Bunların yanında, paydaşlar arasında çatışmalı ilişkiler, projenin başarısında kaçınılmaz bir etkidir. Ne yazık ki, geleneksel proje teslim yöntemleri bu sorunların üzerine bir ışık tutmakta yetersizdirler. Bu nedenle, bu sorunları çözecek daha uygun bir teslim sistemine ulaşmak için Tümüleşik Proje Teslim (TPT) sistemi geliştirilmiştir.

Bu yenilikçi sistem, Taraflar arasındaki çatışmalı ilişkileri azaltmak, paydaşlar arasında daha fazla işbirliği sağlamak, kaynak ve malzeme tüketimi optimize etmek ve işçilerin performanslarını artırmak için gelişmekte olan bina bilgi modellemesi ve yalın inşaat ilkelerinden geliştirilmiştir.

TPT'nin kısıtlı uygulamaları dünya genelinde görülmüş ve Amerika Birleşik Devletleri'nde giderek yaygınlaşmış olmasına rağmen, Türkiye ve Ortadoğu'da uygulanmasına henüz başlanmamıştır. TPT'nin yaygın kullanımını, ilişkilerdeki riskler, yeni yasal çerçeve gereksinimi, yakın ortaklık kurma zorluğu ve yeni yetkinlikler ve becerilere duyulan ihtiyaç gibi faktörler engellemektedir. TPT'nin Türkiye ve Orta Doğu'da yaygınlaşmasını desteklemek için, AEC sektörü profesyonelleri ile bir araştırma yapılmıştır. Katılımcılar, inşaat projelerindeki Bütünleşik Proje Teslim Yöntemi ve Bina Bilgi Modeli uygulamaları hakkında bilgi sahibi uzmanlar ve profesyonellerden oluşmaktadır. Bu çalışma AEC profesyonellerinin TPT hakkındaki tutumlarını gözlemlemek ve TPT kullanımlarını sınırlayan engelleri belirlemeyi amaçlamaktadır. Bunun yanında, YBS teknolojisinin TPT'nin gelişmesi ve uygulanmasını güçlendirmedeki etkisi araştırılmıştır. Sonuçlar sektörün TPT'ye ilgisi olduğunu ve kullanımından yarar beklediğini göstermektedir. Katılımcıların 94%'ü bir TPT projesinde yer almaya isteklidirler. Bulgularımıza göre değişim korkusu, TPT farkındalığının eksikliği ve TPT için uygun yasal çerçevenin eksikliği, uzmanların belirttiği ana engellerdir. Bu nedenle, TPT'nin Türkiye ve Orta Doğu'daki AEC sektöründe kullanımını teşvik için, eğitim sistemi veya gerçek reklamlar ile yeterli tanıtım ve promosyon, uygun yasal düzenlemeler ve destekler gibi ek tedbirler uygulanmalıdır. Bulgular, katılımcıların çoğunun TPT'nin önümüzdeki 5 ila 10 yıl içerisinde pazarın %5 ila 10'unu kapsayacağını tahmin ettiğini göstermektedir.

Anahtar kelimeler: Tümüleşik Proje Teslimi (TPT) – Yapı Bilgi Sistemi (YBS) – işbirliği – fizibilite çalışmaları – inşaat, mimarlık ve mühendislik sanayisi

To My Beloved Family...

To students...

ACKNOWLEDGEMENTS

I would like to express my sincere appreciation to my advisor, Dr. Aslı AKÇAMETE GÜNGÖR, for her continuous guidance, support, and encouragement throughout this process. I would also like to thank my committee members, Dr. Mustafa Talat BİRGÖNÜL, Dr. Rıfat SÖNMEZ and Dr. Gökhan ARSLAN, for their continuous support during the course of this research.

I would also like to thank students and faculty members of the Department of Building, College of Architecture and Urban Planning, Shahid Beheshti University, Dr. Amirhossein MOHEBBIFAR for participating in my research. Special thanks go to Dr. Reza GOLDARAN, R.A. Hacı Hüseyin EROL, and the whole research assistance team of Middle East Technical University, division of Construction Engineering and Management for their kind support.

I would also like to thank R.A. Mehdi ABBASI IRANAGH, R.A. Saman AMIN BAKHSH, R.A. Emad REZVANKHAH, Maryam DANESHVAR, AYAKLI INSAAT Pvt. Ltd (SELBUT CONSTRUCTION), Matineh EYBPOOSH, TARIGH OMRAN and VIADUCT Associate Construction, and all other participants without whom this research would not have been possible.

R.A. Gözde BILGIN, R.A. Bartuğ Kemal AKGÜL, R.A. Şemsettin BALTA, and Mr. GASSEMI also deserve thanks for their help and cooperation.

I would also like to thank my colleagues Dr. Ahmet Levent KALAÇ with whom I have carried out this research. Special thanks go to Dr. Muhammet Burak KILIÇ, Dr. Murat ALTUN and Dr. Ashkan VAKILIPOUR; without their support and guidance I would not have been able to complete this work.

Lastly, I would also like to express my deepest appreciation to my parents, my Aunt Asst. Prof. Dr. Faranak ABBASZADEH TEHRANI from Seattle University and my uncle Prof. Dr. Farzad ABBASZAD TEHRANI from Manchester University, and all of my family for their support.

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LIST OF ABBREVIATIONS

ADTF	Australia Department of Treasury and Finance
AEC	Architecture – Engineering – Construction
AGC	Associated General Contractors of America
AIA	American Institute of Architects
BIM	Building Information Modeling
CHCA	Chamber of civil engineers in Ankara
CIAC	Construction Industry Advisory Council
CII	Construction Industry Institute
CM	Construction Manager – a person or firm acting in an agency role
CMA	Agency Construction Management – a management process
CMAA	the Construction Management Association of America
CMAR	Construction Management at Risk – a delivery method
CMR	Construction Manager at Risk – a person or firm acting in an at-risk role
CURT	the Construction Users Roundtable
DBB	Design Bid Build
FIDIC	Fédération Internationale Des Ingénieurs-Conseils
IFMA	International Facility Management Association
IPD	Integrated Project Delivery

IPMA	International project management association (both Iran and Turkey branches)
IRSCE	Iranian society of consulting engineers
LCI	Lean Construction Institute
LPS	Last Planner TM System
P2SL	Project Production Systems Laboratory
PMBOK	Project Management as Body of Knowledge
PMI TR	Project management institute of Turkey
PMI	Project Management Institute
PPA	Public Procurement Agency
PPC	Percent Planned Complete
PPC	Project Partnering Contract
ROI	Return on Investment
SSF	State Supply Office
TC	Target Costing
TCA	Turkish contractors association
TCEO	Tehran (and Tabriz) Construction Engineering Organization
TVD	Target Value Design
UCCET	the Union of Chambers and Commodity Exchanges of Turkey

CHAPTER 1

INTRODUCTION

The construction industry is generally well-known for its conflicts, clashes and lack of creativity and productivity. Mainly the Architectural-Engineering-Construction industry is suffering from the inadequacy of the procurement process. This sector is the one and only non-farm sector, which had experienced a constant descent in productivity from 1964 to 2004 (Teicholz, 2004). This sector is the one and only non-farm sector, which experience a constant descent in productivity during the last years of the 20th century, but also continues to have productivity problems in this century (Figure 1). Many factors have effects on this productivity decline such as laws and regulations, complex designs and building systems, technological limitations among others. A major reason for this decline is traditional project delivery methods which foster adverse relationships between main stakeholders (Teicholz, 2004)

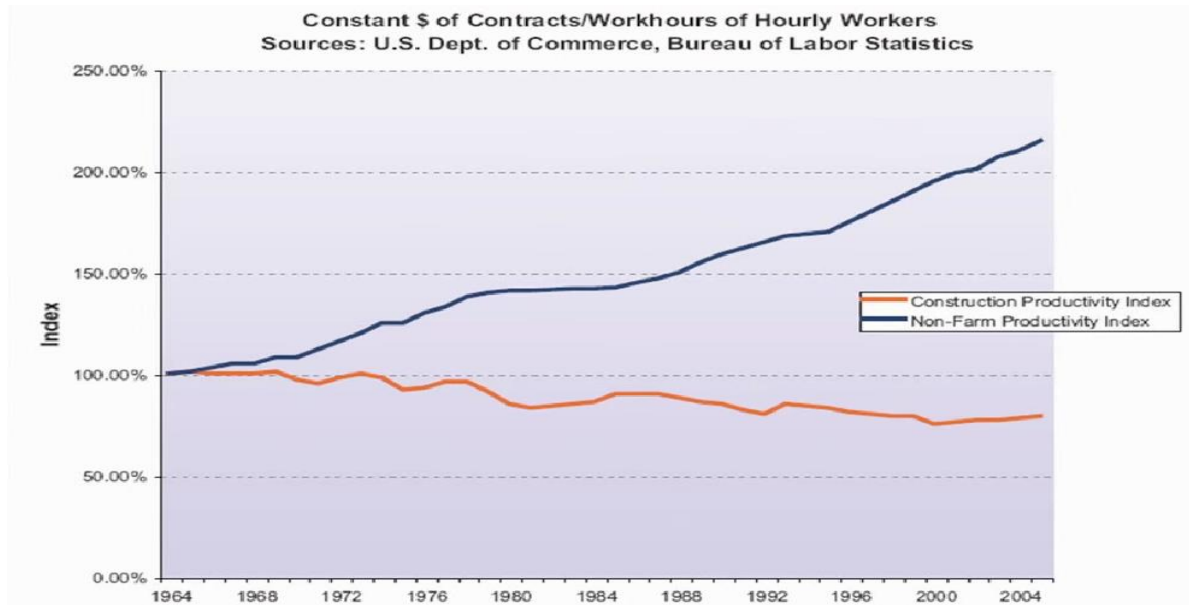


Figure 1 Comparison of productivity in construction industry with non-farm industry (Teicholz, 2004)

In order to solve the procurement process related problems, the Integrated Project Delivery method had been introduced in Australia as a project alliance system. Then, the system transferred to the United States and Canada. American Institute of Architecture (AIA) started to bring into vogue this system. It means that this type of project delivery method transformed into an official and comprehensive way. According to all these; now integrated project delivery system could be able to hold about one percent of whole construction market of the United States. Even though; integrated project delivery method is an absolutely new method, about six standard contracts have been published by the official organizations in USA and Australia. But, still it is not well known in Turkey and the Middle East. The American Institute of Architects (AIA) currently defines IPD as "a project delivery method that integrates people, systems, business structures and practices into a process that collaboratively harnesses the talents and insights of all participants to reduce waste and optimize efficiency through all phases of design, fabrication and construction". This system considered as the most faultless system which ever been recruited and tries to maximize the results of the project by the collaborative approach of participants and bonding their risk and reward to the outcome of the project.

According to all the professionals and experts interviewed; the integrated project delivery method will have a large market share in the near future. This is especially true considering the critical role of Turkey's Architecture-Engineering-Construction industry not only in the Middle East but also in the world. Engineering News Record 2015 world construction company ranking reports bear witness to this: In 2015, about 44 Turkish international contractors ranked among 250 of the world's largest companies (Reina & Tulacz, 2014) That's why acceptance of the Integrated Project Delivery method in such a high potential country as Turkey where the Architectural-Engineering-Construction industry is well developed, is inevitable. Architectural – engineering – construction industry is one of the largest material consumers in the whole world (Department of Commerce, 2004), so the necessity for a coherent system settlement is obvious. According to the State Supply Office's (Devlet Malzeme Ofisi – DMO) annual reports, Turkey is one of the largest consumers of material in the region; therefore, the application of integrated project delivery is definitely crucial. It is so important to point out here that this is not limited to governmental projects, the unofficial and common types of integrated project delivery methods have been applied in the private sector for many years.

There are two other aspects which demonstrate the significance of the Integrated Project Delivery method in the region. The first one is the cohesive approach of the main stakeholders and the second one is direct involvement of the owner in his own project and all its specifications, meanwhile awareness of the owner about all details of the project will be raised. Parallel to these two; IPD enables participants to optimize material consumption and resource usage, schedule the time and determine the best value for the project together with concepts like lean construction and building information modeling.

By raising awareness of IPD among key role players in the industry, requests and demands for utilization of this system are increased.

Exactly like what happens to other industries which was experienced both evolvments of technology and improvements in efficiency; Architecture, Engineering, and Construction (AEC) industry employed building information modeling and integrated project delivery method to compensate these evolvments and improvements.

Overall consequences of this study together with obtained results from experts and literature reveals that the probability of transition from design-bid-build and design-build system to integrated project delivery is tremendously high; however, there is not a specified timetable and due date for this . Nevertheless, there are issues which shadowed on this transmission. There are issues related to construction project procurement process such as, government regulations, lack of expertise in building information modeling, legal and law related problems of integrated project delivery method, attempt to make the architectural – engineering – construction industry a whole, and whether the economic condition in Turkey and the Middle East would accept IPD or not. All of these issues will be discussed in following chapters.

This research attempts to clarify the attitude of role players toward collaborative systems and IPD, try to find factors which negatively affect the implementation of this system, examine information and experience of respondents about collaborative procurement systems and building information technology, and lastly defines an approximate due date for wide application of integrated project delivery in Turkey and the Middle East Architectural-Engineering-Construction industry.

The researcher has not come across a similar study in the region in the literature so far. The exact date about acceptance and utilization of integrated project delivery in the public and private sector of the region. In order to quantify, a survey has been developed as a tool to figure out the approximate due date of wide spread acceptance, the percentage which IPD would hold in procurement market, the main obstacles to acceptance, to measure experience and information of sector members about BIM and IPD, synchronization of IPD with other delivery method, success factors for implementation of IPD and even the industry members interested to participate in integrated project delivery method project or not.

As the scope of this study, a survey had been designed and it has been sent to about 3200 of industry members who has at least 2 year of experience in Architectural-Engineering-Construction industry and procurement process of Turkey or Middle East countries like Iraq, Iran, Qatar, Saudi Arabia, Azerbaijan, Afghanistan and Turkmenistan. Main respondents fall into 10 categories as; owner, developer, architect, facility manager,

engineer, subcontractor, general contractor, supplier/manufacturer, consultant and educator.

Respondents answered questions about factors which might have an influence on project delivery systems and their acceptance by public and private sector of the region, and they have been asked about the efficiency and sufficiency of current prevalent systems. After that, they were asked to illustrate their own information and experience about the main principles of project delivery methods and building information modeling technology. There was an attempt to find main shortcomings and concerns of sector members toward this delivery method. According to collected data and received results, solutions had been generated.

The main goal of this research is to find the attitude of members of Architectural-Engineering-Construction industry of the Middle East region toward this delivery method and generate an approximate due date time table for general acceptance and settlement of this system in countries with relatively similar cultural and economic conditions, and show the results in a way that makes sense.

As Main objective of this thesis, firstly, is illuminating the concept of IPD. Then, it will discuss on the main principles of IPD. Afterwards, the attitude of industry members toward Integrated Project Delivery method will be measured. The obtained results of this study supposed to increase awareness of industry members in the region and attract attention of Turkish and Middle Eastern contractors, owners and architects to employ IPD.

Worth declaring here that chapter two clarifies wide range review of literature about IPD. In this chapter, the historical chart and the evolution of project delivery systems will be illustrated. Then, the most important three delivery method is determined as Design-Bid-Build, Design-Build and Construction Management at Risk. These three main delivery methods will be compared with IPD and their advantages and disadvantages are tabulated.

Eventually, the main principles of IPD, the main principles of BIM for support IPD and previous surveys from different countries are provided. The previous studies in various countries show the importance of integrated project delivery and collaborative procurement approach and its usefulness for their architectural-engineering-construction sector.

Chapter three will demonstrate the hired methodology to carry out the research. This chapter includes five steps from definition of main IPD concepts to overall assessment of obtained results.

Chapter number four has divided the study into five main areas. It means that five main headlines for the study are defined. Obtained results analyzed in this chapter and compared to previous works. Two correlations, also, are taken into account. First one is the correlation between BIM and IPD and the second one is the correlation of the industry members' experience and their eagerness to participate in IPD project.

Chapter number five demonstrates the results of the analysis and findings. The correlation between BIM and IPD is high. It means that more than half of the experienced experts with IPD, experienced with BIM, as well. Furthermore, the correlation coefficient of work experience and IPD eagerness is absolutely positive. In this chapter, additionally, the limitations are claimed and suggestions for further studies are recommended.

CHAPTER 2

LITERATURE REVIEW

As a definition for the meaning of project that's simply defined by Merriam-Webster dictionary:

“A planned piece of work that has a specific purpose”

More specifically, what is a project?

“It is a temporary endeavor undertaken to create a unique product, service or result”

(Oberlender, 2000).

The project is temporary; because it has a beginning and an ending due date and none of the two projects is exactly the same because of their locations and milestone dates. Moreover, a project is unique, it means that the project is not an iterative scenario. Each project has defined resources and scope. For any project, a pre-defined and planned set of actions are envisioned in order to accomplish the desired goal (Figure 2) Over and above; project team is mainly composed of the people who don't know each other and don't work together usually, they are from different organizations and from multiple geographical locations. This unique and temporary process should be expertly managed in order to achieve desired results, which means that the project process should satisfy the desired scope and schedule within budget.

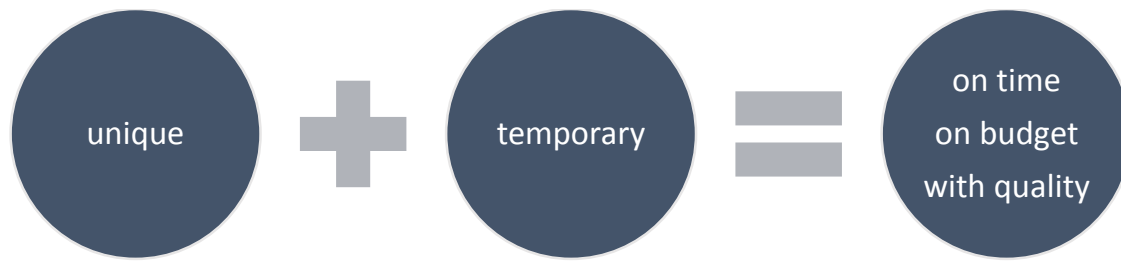


Figure 2. The project definition

Project management, then, is “the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements” (Project Management Institute, 2013).

Project management processes fall into five groups:

1. Initiating
2. Planning
3. Executing
4. Monitoring and Controlling
5. Closing

And Project management knowledge draws on ten areas:

- 1- Integration
- 2- Cost
- 3- Human resources
- 4- Stakeholder management
- 5- Scope
- 6- Quality
- 7- Communication
- 8- Time
- 9- Procurement
- 10- Risk management

As it's obvious the 'integration' is the first and the most important subject of construction management knowledge. Digging into the details about the principles of integration, the exact correlation of 'integration' and 'integrated project delivery' system would be clear (Project Management Institute, 2013). Definitions for project delivery methods are available in a wide range in literature, but commonality of all of them is that the project delivery system is a method by which a project is contracted for construction. Like many of other fields of management knowledge, delivery methods have their own deficiencies and shortcomings. In the past two decades, many of the experts, researchers and professionals of construction engineering and management field have endeavored to provide a wide range of suggestions and solutions to solve project delivery related issues. Defected collaboration and cooperation between the main parts of the project resulted in emerging of methods such as 'partnering', 'project alliancing' on the basis of relational contract; therefore, the success of these two methods leads to accomplishment of novel phenomena "integrated project delivery system".

Integrated project delivery is the ideology of collaborative thinking, team working and the outcomes of the project get cured by this ideology. Integrated project delivery had been represented in the industry in 2007 by the main four principles as: mutual benefit and reward (win-win relationship), mutual respect and trust (fostering the sense of trust and collaboration), early involvement of key participants and appropriate risk and reward allocation.

In spite of the advantages of integrated project delivery, still there are barriers to acceptance of this method because of unfamiliarity of industry members with IPD (Shahhosseini, Hajarolasvadi, & Nojan Naderi, 2013). On the other hand, limited number of projects conducted with integrated project delivery and their brilliant results shows the importance of this method. (Amirarjmandi, Eghtedari, & Mazaheri, 2011)

Additionally, innovations in AEC industry are fewer in comparison with other sectors especially in procurement phases. On the other hand, evolution and advances in technology such as Building Information Modeling (BIM) technology as well as owners' on going new demands for more efficiency resulted industry members to find an appropriate and suitable

remedy for these concerns. Consequently, all these efforts resulted in the development of Integrated Project Delivery (IPD) method which increases cooperation and team spirit between constructing team members and Building Information Modeling (BIM) became a catalyst for leveraging IPD. This system is considered the most faultless system which has ever been recruited. IPD is a new model of team building and risk allocation among owner, architect, engineer and contractor to align interests as a means of achieving project success. BIM is the use of a parametric, intelligent database which is not only use of 3D design tools to characterize existing architectural and engineering design, but it can be used to explore and manage the construction process, do energy optimization, support sustainable construction, calculate costs, and aid facility management.

This research is focused on demonstrating the general attitude of construction companies toward accepting a new collaborative delivery system. IPD system will help construction projects to be efficient in cost and time with decreased waste and increased outcome. Also worth noting here that this collaborative attitude toward project delivery could be considered as one of the prevention ways of the root causes of construction cost overruns (Rosenfeld, 2014).

Furthermore, this study will show the pace of adoption of Turkish and Middle Eastern construction companies to this new method, together with suggestions for enhancing IPD's market share. In upcoming chapters, principles of IPD and BIM will be considered and their correlations and pairwise comparison matrix will be generated. Moreover, the factors which affect the implementation of IPD in region negatively will be discussed.

2.1 The evolution of project delivery systems

The mainly accepted world public procurement policy was design-bid-build (DBB) in the 1940s (Miller, Garvin, Ibbs, & Mahoney, 2000) Afterwards, due to problems like complexity of buildings and need for other experienced and specialized working groups and experts, one and only the main contractor could not be able to contact with whole of the project team participants which resulted in inefficiencies, non-cooperation and separations of working groups (Department of Commerce, 2004). In addition, the integrations between main parties were not helpful enough. So that in order to cover this

cooperation shortcomings expenses had been increased (Gallaher, O'Connor, Dettbarn, & Gilday, 2004). As a consequence of DBB's shortcomings in a complex project, such as, open communication deficiency and cooperation crunch, construction management at risk (CM@R) had been emerged in the early 1960s (Tatum, 1983). In many ways this delivery method is similar to DBB with the difference that the construction manager at risk (CMR) playing the same role of general contractor in the project (The Construction Management Association of America, 2012). Nonetheless main problems such as disintegrated project participant groups was remaining the same.

About 1990s, design-build (DB) was established. After the establishment of this method, research and studies about it had illustrated that design-build solve some of the problems in the industry but created some other new ones. If some of the shortcomings were disregarded, DB would be able to satisfy cost, schedule and quality related issues (Konchar & Sanvido, 1998). Afterwards, DB boomed and distributed to projects all over the United States. Meanwhile, some of the infrastructure projects were being conducted by a new system that had been emerged under the name of project alliancing (Noble, 2009) but foremost "project alliancing" system was used in an infrastructure project in Australia and then transferred to United States and developed (AIA California Council, 2007). The more projects conducted, the more inefficiencies of the system was eliminated. The more time passed, the more satisfaction achieved from this system. This system, of course, had tried to manage outcomes by stimulating the sense of togetherness in the industry and make participants' goal definitions and aims much closer to each other during their contribution (Australian Department of Treasury and Finance (ADTF), 2009).

In line with Figure 3, over all of this development path Integrated Project Delivery system had been introduced in United States in mid 1990s. The integrated project delivery method tries to capture the full capability of all participants by utilizing of building information modeling as an extremely necessary tool and process which is a visualization technique, automatic and intelligent way to design. Building information modeling enables approximately all of the participant from the smallest working groups of sub-contractor to owner for collaborating on well-defined and easy-to-understand environment (The Associated General Contractors of America, 2010). Worth adding here that the main idea

of integrated project delivery method for project control came from the last planner system. Last planner system had been introduced to control production (Cho & Ballard, 2011). In other words, the main idea of LPS and IPD is eliminating errors from the beginning (Hamzah, 2009).

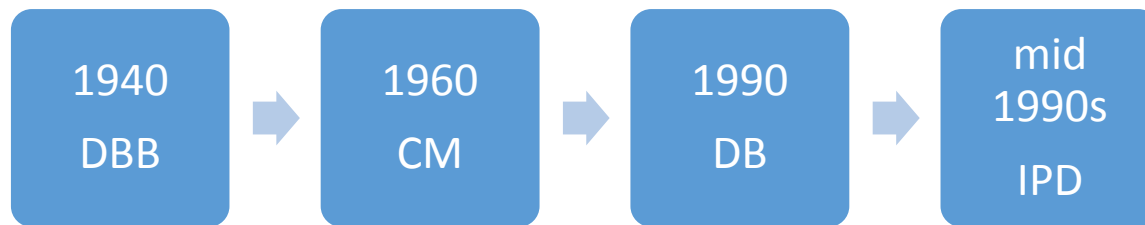


Figure 3. Project Delivery Timeline

BIM helps all participants from owner to subcontractor to carry out tasks under IPD contract from zero (conception) phase to last (occupancy) phase. So that when these two subject come together in the project, exploit the maximum potentials of members and form a new whole (AIA California Council, 2007). Some of official organizations and reliable associations such as the American Institute of Architecture, California Council (AIA) and The Associated General Contractors of America (AGC) totally agree with and support IPD. By the way, they release many of documents, reports, surveys, papers, user manuals and guidelines for the AEC industry (AIA California Council, 2007); (The Associated General Contractors of America, 2010). But, the amount of projects using IPD remains relatively small in comparison with other delivery methods. Even though, the projects which were delivered by this method have been resulted in successful outcomes (Matthews & Howell, 2005). As an example the implementation of integrated project delivery and building information modeling in “auto desk one market” project could be mentioned here (Becerik-Gerber, Kent, & DDes. , 2009).

2.2 Reasons of slow adaptation of the AEC industry to IPD

In the scope of this study the surveys and interviews mainly conducted in Turkish and Iranian construction societies. Especially Turkey is the most powerful and growing economy in the region according to its GDP (United Nations Statistics Division, 2013). The economy of Turkey is relatively dependent on the construction sector and top ranked international contractor companies (Reina & Tulacz, 2014). However, still many of challenges hindrance the wide application of this new system (nejati, javidruzi, & mohebifar, 2014). According to industry, there are reasons to slow adaptation of AEC industry with IPD (Figure 4).

1. First of all; risk related issues to constitute a working group could be an obstacle to adoption with IPD. Because all parties should have maximum trust to each other. As well as disagreement arose between them about an issue, they would be able to solve it simply, otherwise that will turn to a chaos (Autodesk White Paper, 2008)
2. Secondly; the legal system could not cover all related concerns and issues. IPD is a generation of DB system, but there are many differences between IPD and other traditional system's necessity for a comprehensive legal framework is inevitable and non-negligible. Therefore,
 - a. The first step is standard contracts.
 - b. The next step is well defined guide for each party (every party is responsible for his own professional services and tasks),
 - c. As last stage, insurance, entity formation and joint venture are evolution needed issues
3. Thirdly; close relationships because, like other delivery methods, roles and responsibilities are defined for all parties, but together with close relationships and partnership. So, this role and relations should be defined accurately and adequately to prevent other upcoming problems.
4. Lastly; this type of cooperation, alliancing and integration seek for new talents, skills, core competencies and insights. In the other words, Integrated Projects

Delivery is relatively new and this type of resources is limited. (AIA California Council, 2007) (Autodesk White Paper, 2008) (Autodesk White Paper, 2008)

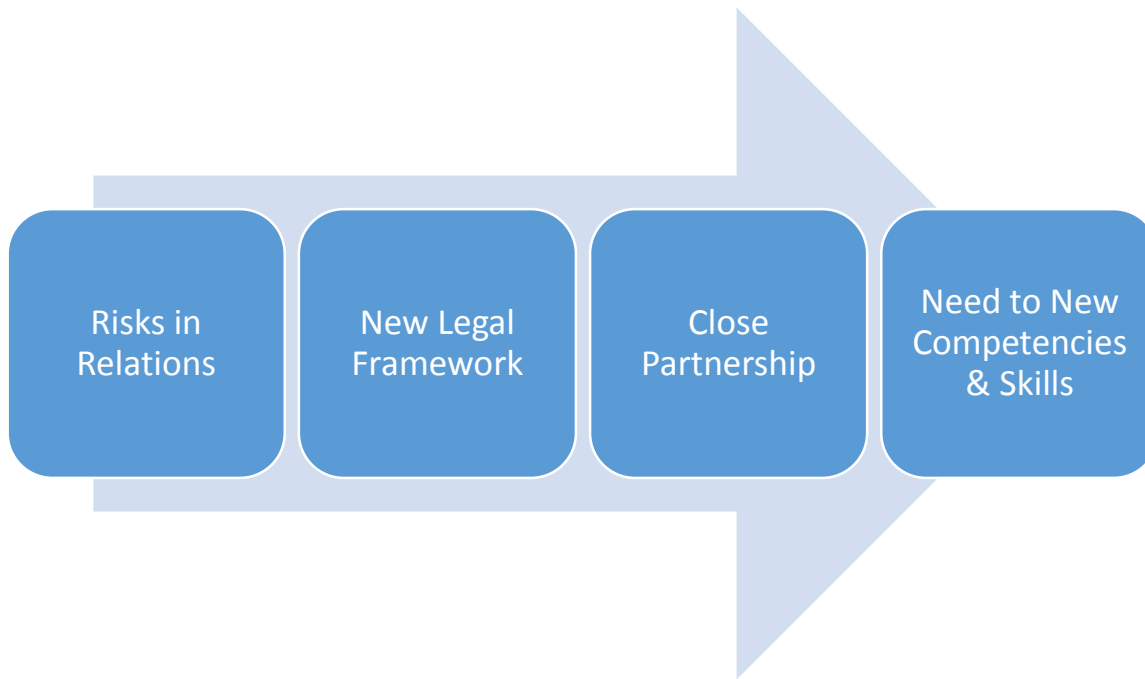


Figure 4. Reasons to slow adaptation of AEC industry with IPD

2.3 Overview and definition of project delivery methods

The first and most commonly used definition to project delivery system according to CMAA is:

“Project delivery method is a system designed to achieve satisfactory completion of a construction project from conception to occupancy” (The Construction Management Association of America, 2012).

IPD is a contractual agreement between stakeholders of the project in a way that it binds the interests of them together. Therefore, compensations directly depend upon project outcome and success of the project. The main aim of this delivery system is to eliminate

adversarial relation between the parties, foster them to perform as a whole and decrease the waste. The American Institute of Architects (AIA) currently defines IPD as

"A project delivery method that integrates people, systems, business structures and practices into a process that collaboratively harnesses the talents and insights of all participants to reduce waste and optimize efficiency through all phases of design, fabrication and construction" (AIA California Council, 2007).

Integrated Project Delivery (IPD) seeks to improve project outcomes through a collaborative approach of aligning the incentives and goals of the project team through

- Shared risk and reward,
- Early involvement of all parties,
- An early definition of project goals,
- Employing appropriate technology like information modeling technology as a tool to leverage the efficiency and
- Lean construction method as process to this delivery method,
- Well defined constructional relations,
- Clear definition of roles and responsibilities of each stakeholder,
- Foster willingness to change in industry members and collaborative team spirit
- A multi-party agreement

The associations and entities which have the most contribution for and publications about integrated project delivery is the American Institute of Architecture in the first row. AIA has various publications and guides, case studies and contract documents and standards, e.g., AIA A195/B195/A295¹, AIA C195/C196/C197², consensus DOCS300³, AIA A195/B195/A295, AIA A195/B195/A295, AIA C195/C196/C197 and Consensus DOCS 300 - for IPD.

¹ (A195–2008, Standard Form of Agreement Between Owner and Contractor for Integrated Project Delivery
B195–2008, Standard Form of Agreement between Owner and Architect for Integrated Project Delivery
A295–2008, General Conditions of the Contract for Integrated Project Delivery)

² (C195–2008, Standard Form Single Purpose Entity Agreement for Integrated Project Delivery
C196–2008, Standard Form of Agreement Between Single Purpose Entity and Owner for Integrated Project Delivery
C197–2008, Standard Form of Agreement Between Single Purpose Entity and Non-Owner Member for Integrated Project Delivery)

³ (ConsensusDOCS300: Tri-Party Collaborative Agreement)

After AIA other organizations such as Australia department of treasury and finance (ADTF), states that a delivery method may employ any one or more contracting formats to achieve the delivery.

In today's world, many of other delivery methods are variations of four main delivery methods (Konchar & Sanvido, 1998) which could be listed as:

- Design-Bid-Build (DBB)
- Construction Management at Risk (CMAR)
- Design-Build (DB) and
- Integrated Project Delivery (IPD).

As it was mentioned previously, in upcoming sections additional information about these delivery methods with their related variations will be presented. However, this Question can still be raised that is the New Deal of integrated project delivery the best and faultless delivery method till now? And would it widely be accepted by AEC industry of the Middle East countries or Not? As a comparison of integrated project delivery method with other traditional methods; American Institute of Architectures generated a table (Table 1). In this table the main outlined concepts are being compared. Subjects like team foundation, system's process, risk and reward, information technology and agreements have been sifted. Therefore, the superiority of IPD over former delivery methods is clearly depicted.

In section 2.4. Main three traditional types of project delivery methods will be discussed in detail and they will be summarized. Also, their pros and cons collected from different literature sources.

Table 1. Traditional delivery systems vs. IPD (AIA California Council, 2007)

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

2.4 Traditional types of delivery methods

The construction industry mainly consists of the various parties e.g. owner, architects, engineers, contractors, sub-contractors, suppliers, manufacturer, etc. (Lichtig, 2005). Generally the timing, costing and interrelations between the parties is determined by the type of delivery method. This delivery method is chosen by the owner (Alarcón & Mesa, 2014); (Lichtig, 2005); (Jackson, 2010). Therefore, delivery methods assign and align the responsibilities and the duties of each participant to them. In other words, the type of delivery method defines their duty map in detail ((AIA) & (AGC), 2011). The main three outstanding and prevalent delivery methods are Design-Bid-Build, Design-Build and Construction Management at Risk (Alarcón & Mesa, 2014). These methods will be discussed in sections 2.4.1, 2.4.2 and 2.4.3. Integrated Project Delivery method, however, is a newly emerged delivery method (Asmar, Hanna, & Loh, 2013) which will be the main focus subject of this study. The basic introduction of integrated project delivery method will be given in part 2.4.4 and detailed discussions will be provided in section 2.6.

Numerous organizations have weighed to the topic of IPD and its comparisons with previous established systems (Allen, 2007). In addition to the organizations (such as; American Institute of Architecture, Construction Industry Institute, Construction Users Roundtable), main construction magazines (such as Engineering News Record and Trade Line) considered IPD as main delivery system topics of the century (Post, 2011). In this section the three main traditional delivery methods will be summarized. Then the advantages and disadvantages of these systems will be tabulated. As an integrated project delivery compared to three previous methods, obtained results tell that IPD provides higher quality facilities faster and at no significant cost premium (Asmar, Hanna, & Loh, 2013).

Afterward, in order to compare them with integrated project delivery method, IPD will be discussed in the format of these three delivery methods in section 2.4.4. Here we will see the project timeline – cost of change figure (Figure 5). In this figure:

- The main accent is on two lines which represent cost of design changes and ability to impact cost and functional capabilities.
- As we can see from the diagram, the most effort is made in criteria and detailed design of IPD method, where the change of design costs less and the impact on cost and functionality is high.
- In contrast, traditional method takes more effort where the changes are highly priced and opportunity for cost and functionality is low.
- Therefor I can say that comparing to IPD, traditional project falls behind and the period of decision making is out of season.

As obvious in Figure 6; integrated project delivery increases design effort in the early stages of the project. Therefore, design change costs are decreased to their lowest level. For example, when we compare two similar hospital projects, the first one delivered with CMR and the other one delivered by IPD the cost saving of IPD was clear (Bilbo, Bigelow, Escamilla, & Lockwood, 2014).

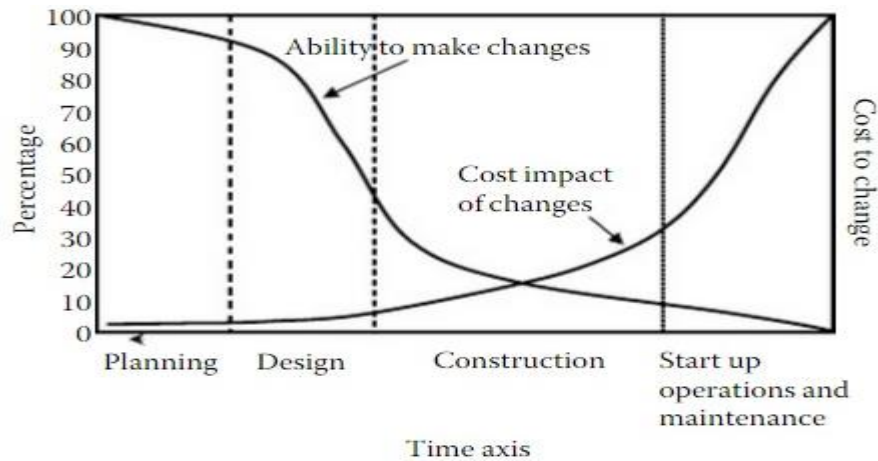


Figure 5 Relation between time and the impact of design changes (adapted from modern construction hand book)

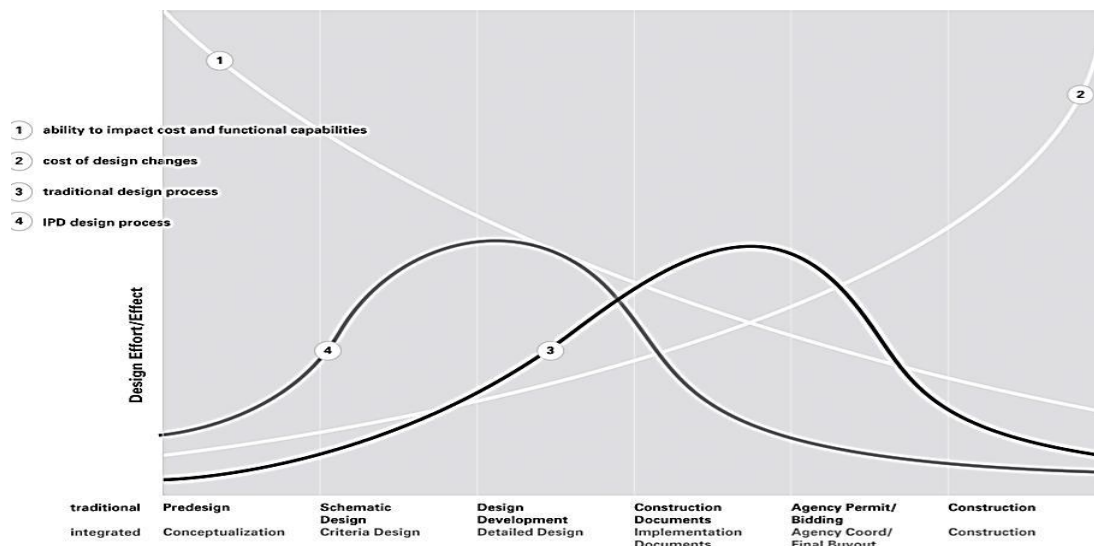


Figure 6. The MacLeamy Curve -Integrated Project Delivery and Design Bid Build design endeavor and their effects on project cost

2.4.1 Design-Bid-Build (DBB):

The traditional U.S. project delivery method consists of three main phases; the design phase; the bid phase and the build or construction phase (Ibbs, Kwak, Ng, & Odabasi, 2003). A common variation is Multiple Primes; in this variation owner directly contracts with separate trade contractors for specific portions of the work rather than with a single general or prime contractor (The Construction Management Association of America,

2012). This method is the most popular and prevalent one all over the world and the most common one for the United States in the 20th century (Konchar & Sanvido, 1998); (Becerik-Gerber & Kent, 2010). This delivery system, also, involves three project phases: design, procurement, and construction. Maybe the most two important reason for this prevalence could be both the market advantage of open competition and the governmental rules which forbids early involvement of general contractor.

In order to give ability to users and a brief the table below shows the pros and cons of design bid build system (Table 2). Although Design-Bid-Build is the oldest and the most prevalent delivery method whole the world, but utilization of Integrated Project Delivery method undoubtedly resulted in better project achievements (Paulson & Boyd, 1976).

Table 2. Advantages and disadvantages of design-bid-build system

Pros	Cons
<ul style="list-style-type: none"> ● Streamlined contractor/consultant interface ● Fewer changes ● Implementation of changes often simplified ● Often a reduction of claims (or number of claims) ● Increased flexibility to address changing conditions ● Reduced administrative burden for the owner ● Improved risk management for the owner ● Cost savings and more certainty of final price ● Greater ability to evaluate contractors on factors other than cost ● Everyone is familiar with this process ● The owner has considerable control ● It is low bid and that clearly defines the cost at the outset 	<ul style="list-style-type: none"> ● Loss of control and reduced Owner involvement in design ● Cost of procurement process (to all parties) ● Difficulty/time comparing different designs ● Cost of risks and contingencies can result in substantial risk premium ● Danger of Design-Build becoming Build-Design ● Environmental/regulatory processes ● The contractor has an incentive to provide minimum compliant standard to decrease cost ● The books are closed. Profitability is the goal for the GC ● The process is entirely sequential ● If the bids come in over budget, considerable time is lost ● There are no constructability reviews

Adapted from (AIA California Council, 2007)

In DBB system, the owner retains a designer and then makes contract with him. Designer together with owner produce design documents and project requirements nevertheless designer is responsible for completing construction documents. This documents, eventually, put out for bid and the general contractor are chosen accordingly. The owner selects the best received bids on the basis of the lowest price. But this is so crucial to note that as the contractor is not involved in the early stage problems couldn't be tackled prior to construction (AIA California Council, 2007). It should be declared here that the contractor couldn't participate in design process prior to construction phase (Jackson, 2010). As shown in the figure below owner is situated squarely between designer and contractor (Figure 7).

The owner is responsible for design changes and errors, therefore contractor may need to look to post-award changes as a means of enhancing profit on the project (Touran, et al., 2009)

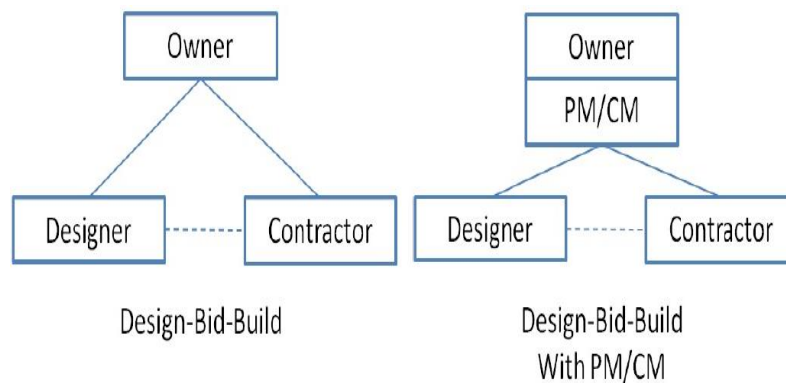


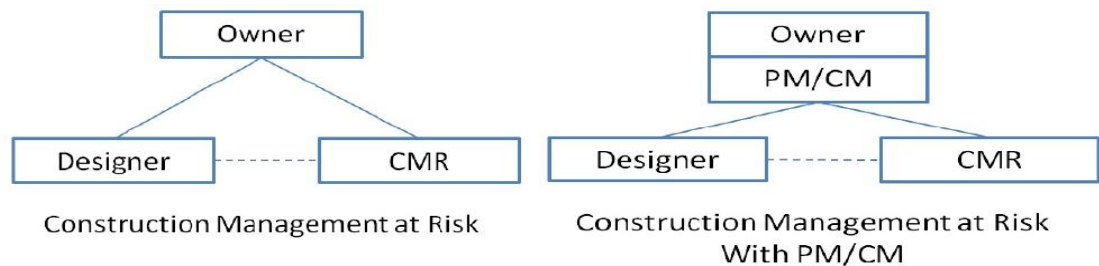
Figure 7. Design-Bid-Build (DBB) (AIA California Council, 2007); (The Construction Management Association of America, 2012)

2.4.2 Construction Management at Risk (CMAR):

This method requires and entails commitment of Construction Manager at Risk CMR to deliver projects within defined schedule and within budget (either Fixed Price or Guaranteed Maximum Price). CMR is a consultant to owner in the design phase and legal equivalent of a general contractor in construction phase. In this method, also, construction manager acts as a specialist and advisor to the owner in the development and design phases. Construction manager at risk, however, assumes construction risks as a general contractor during the construction phase (The Construction Management Association of America, 2012). According to the principles of IPD, construction manager at risk should participate in the earliest possible stage of a project to help the design process. Also, there are two types of construction management:

- I. CMC: construction manager – constructor
- II. CMa: construction manager – adviser

These two models are totally different models by virtue of construction responsibilities. In the other words, CMC known as construction manager at risk (CM@R). Therefore CM@R and constructor are the same in some cases (Figure 8). (AIA California Council, 2007)



Contracts

Communications

Figure 8. Construction Management at Risk CMAR (AIA California Council, 2007); (The Construction Management Association of America, 2012)

Table 3. Pros and cons of the design bid Construction Management at Risk. Adapted from (AIA California Council, 2007)

PROS	CONS
Provides Owner greater control in selecting the CM Through pre-qualifications.	Potential exists for an adversarial
Management of change is more effective with a team approach	relationship between the Architect and CM
Single point of responsibility during construction	The owner must invest equal degrees of
Opportunities for fast tracking	control to both parties.
Constructability reviews avoid delays.	

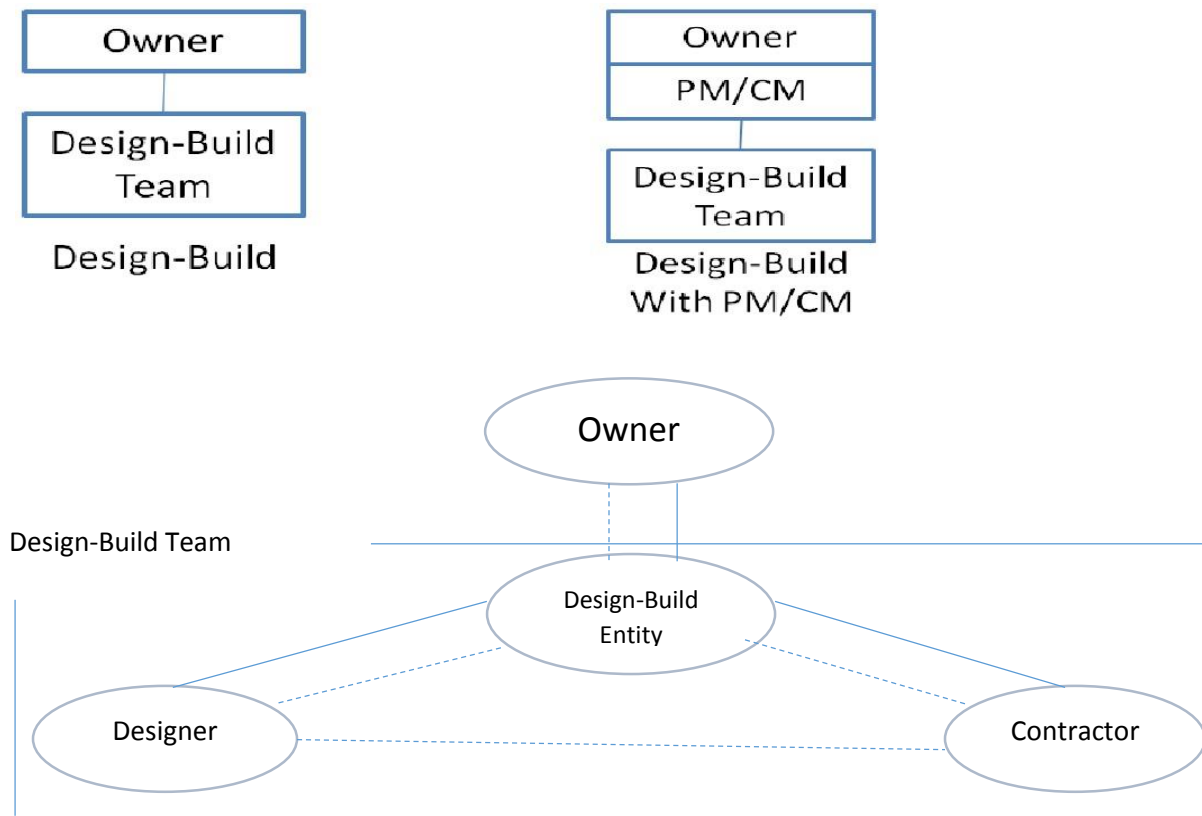
2.4.3 Design-Build (DB):

This method combines engineering and construction under one contract. Common variations are

- The Bridging: firstly the owner employs a designer to develop the design documents to a schematic level and then employs DB contractor who finishes the design and constructs the project and
- The PPP: private investors provide capital in exchange for the revenue that the completed facility anticipated to generate. It means that in this method architectural and engineering design services are combined with construction performance under one contract (The Construction Management Association of America, 2012).

In this system only considered criteria are being defined by the owner. The owner gives the job (design + construction) to the single entity and transfer the risk and coordination of the job. There are many ways for an owner to select the appropriate entity for conducting the job, three of them could be mentioned as price based, qualification based, and value

based (according to criteria documents provided by owner). These three ways are the most popular ways of selecting the suitable and appropriate entity to conduct the (Figure 9). (AIA California Council, 2007). In section 4.1.2 it will be shown that DB is the most suitable delivery system for synchronization with IPD.



Contracts

Communications

Figure 9. Design-Build (DB) (AIA California Council, 2007) (The Construction Management Association of America, 2012)

Table 4. Pros and cons of Design-Build system. Adapted from (AIA California Council, 2007)

PROS	CONS
Provides Owner greater control in selecting the CM through pre-qualifications.	Since Architect and Contractor work under the same umbrella as the checks and balances are lost.
One point of contact.	
Positive impact from a team approach.	
The relationship between the Architect and Contractor is not adversarial since they are the same entity.	The program must be clearly defined by the owner prior to starting.
	Owners should have extensive experience in construction.

2.4.4 Integrated Project Delivery (IPD):

The Integrated Project Delivery method is relatively new in the construction market. IPD is considered the most innovative and faultless delivery system which has been introduced to AEC industry so far. This delivery system attempts to spread risks, responsibilities and liabilities among participants; whether through partnership agreements or multi-party contracts. In Table 5 integrated project delivery did not mention but the differentiation of risk and control of the owner and contractor is obvious in five different types of delivery methods. Worth noting here that Table 5 have been propagated to illustrate the inverse relationship of risk and control for the owner and contractor. For example, owner's risk is the least with PPP while is of the greatest risk with multiple prime. So, there is an upward trend in owner's risk from left to right side of the table. The greatest owner's control on the project is attached to multiple prime method while the risk of this method is the least for the owner. Contrariwise,

public private partnership (PPP), provides maximum of control and risk for contractor. Correspondingly, integrated delivery system enhances the control of the contractor to its maximum possible level and share the risk of project between all participants.

There is a collaboration between all participants –owner, designer, and builder- therefore risk, responsibility and liability for project delivery are collectively managed and appropriately shared. There is a collaboration between all participants –owner, designer, and builder- therefore risk, responsibility and liability for project delivery are collectively managed and appropriately shared.

Table 5. Project delivery methods' risk and control comparison (The Construction Management Association of America, 2012)

P3	DB	DBB	CM@R	Multiple prime
Least		Owner's risk		Greatest
Greatest		Contractor's risk		Least
Least		Owner's control		Greatest
Greatest		Contractor's control		Least

The breakdown of delivery methods in the U.S. construction market is shown in Figure 10. According to CMMA (2012), IPD managed to gain 1% of market share in the last 20 years.

On the other hand, experts and industry members hope that it will reach to 20% of market share in next 10 year (The Construction Management Association of America, 2012)

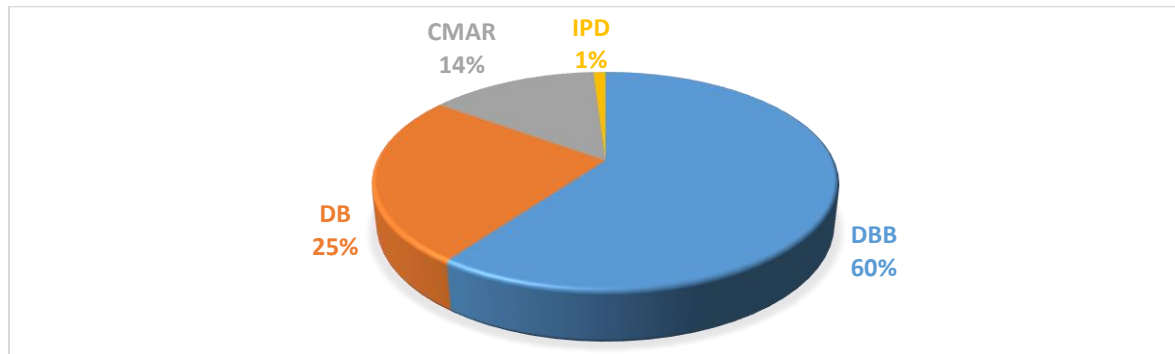


Figure 10. Delivery methods in the US construction market (The Construction Management Association of America, 2012).

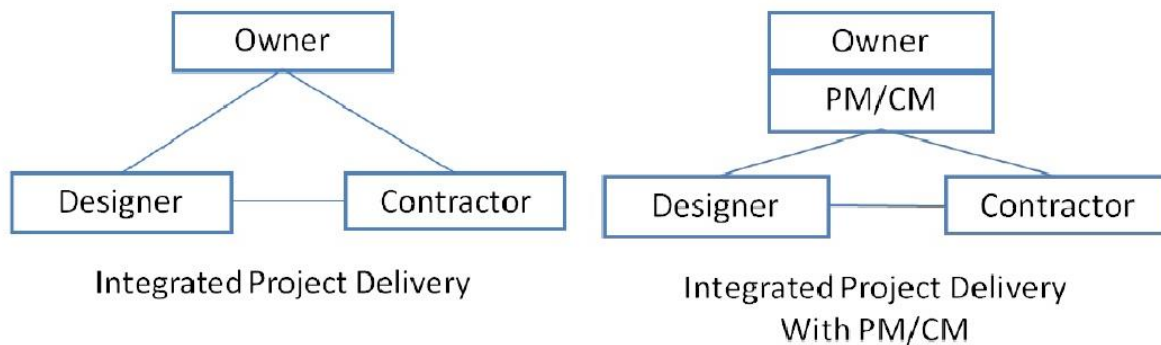


Figure 11. Schematic work model for IPD (The Construction Management Association of America, 2012)

Also, it should be added here that generally the main role of construction manager is giving advice to the owner about the compensation methods (Figure 11); there are three main compensation method which listed as Lump Sum / Fixed Price (LS), Guaranteed Maximum Price (GMP) and Reimbursable. The procurement methods could be dropped down into three

main categories; price based, qualification based or a combination of both (The Construction Management Association of America, 2012)

2.4.4.1 Comparison of process between IPD and common delivery methods

Early involvement of key participants in the project process resulted in more effort in pre-construction phases with a complete design and less challenge in construction phases. Therefore, first stages (consist of conceptualization, criteria design and detailed design) in alliance and collaboration, requires more effort than traditional methods. Perfect design and accomplished documents in pre-construction phase resulted in shortenings in other stages (consist of implementation documents and agency review/buyout). Moreover, synchronization of project in construction stage resulted in time saving (Figure 12).

According to the Figure 12, in the projectonal methods Different elements of project got engaged in different stages of the project. While, in IPD, The concepts of “what”, “who” and “how” in the project are defined at the very beginning of the project and thereby an immense amount of time can be saved.

1- Conceptualization

In this phase “what should be constructed” is determined

All the stakeholders predefined

Key technologies like BIM introduced

“Structure of expenses “discussed with more details

“Prime schedule program” have been defined

2- Criteria design

The project is born on this stage. All possible options have been examined and have been analyzed. If the BIM decided to be employed; via the definition of “what if” scenarios, the result of each possible scenario will be sifted.

The first conceptual model gets generated and visualized

The scope and budget of the project are determined

Owner; endorse the last destination of the project

3- Detailed design

After “what” stage finished, in this stage key design decisions get finalized. This stage is relatively longer than traditional methods because more details are considered. In this stage, also, contributions of sub-contractors are considered.

4- Implementation document

This is the stage of transmission from “what” to “how”. The procedure of drawing developments depends on contractor’s contributions. But nonexistence of contractor in this stage is a tremendous shortcoming for traditional delivery methods.

The design documents are finalized therefore a pre fabrication could take place in some parts of the construction.

This document could be visualized through BIM for other organizations like banks etc.

5- Agency review

The stage of getting permissions are similar to traditional delivery methods. In the integrated project delivery method, however, regarding to the existence of BIM, the agency review step is accelerated because of the BIM and its visualizations.

6- Buyout

All of key participants and main role players are gathered in the initiation phases of the project. In buyout stage, only the rest of the contracts are signed by subcontractors who do not have a critical role in the design.

7- Construction

In this phase the advantage and the excellence of integrated project delivery and integrated model has been explicit. While many of experts believe that in the current project delivery methods, the construction phase is the last phase for

corrections, issues and solution generations for design shortcomings; in integrated project delivery method, both of criteria design and implementation document generation phases are the last phases for resolving the design errors. It means that the responsibilities and the duty of construction manager has been decreased.

Regarding to integrated project delivery and its pre-construction efforts some of inconveniences have been satisfied (i.e. Decrease of construction manager efforts for solving the issues, alleviation of RFI s, because the constructor get involved enough in the design phase, less effort of the construction management company because of exact correspondence of construction drawings with as-built drawings, more prefabrication because design documents have been released prior to implementation stage, etc.)

8- Closeout

In close out stage an intelligent 3D model is submitted to the owner. Overall, an integrated project delivery is dependent on condition and working structure. For instance, if the working structure is based on incentive, at the end of the project exact amount of incentives will be calculated.

Also, worth adding here that BIM could help to the owner for maintenance and enable the owner to compare the real performance with programmed performance. (Amirarjmandi, Eghtedari, & Mazaheri, 2011)

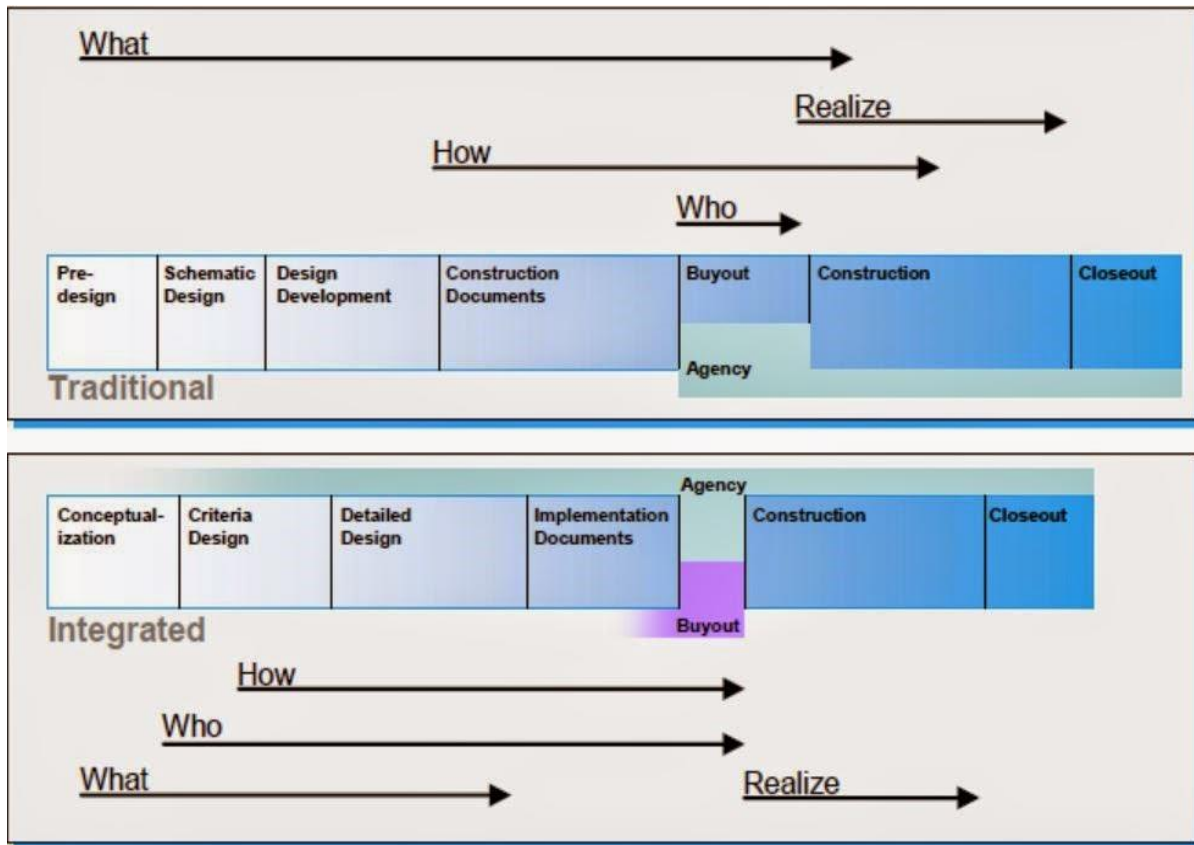


Figure 12. The difference between traditional and IPD processes from Autodesk white paper "Improving Building Industry Results through Integrated Project Delivery and Building Information Modeling"

According to Figure 12, it is undeniable that the project period is shorter than traditional delivery systems because of quick agency review, quick mobilization and shorter construction duration. In Figure 12, each of the arrow involves information about the phases that involve decisions about who is going to build, what should be built and how could it be built.

What line: This line is showing the major design decisions, the alternative preference and the structural analysis, which realized and dissolved earlier in IPD regarding to contractors' contributions in the early stages of the project. In integrated project delivery method the design documents are more accurate and thorough so that the document implementation phase and buyout phase get shorter.

Who line: In traditional methods contractor win the bid in the buyout phase; therefore both of the construction planning and the drawing revisions consume time. But, in integrated method, both of these efforts finalized prior to construction.

How line: This line in traditional and common delivery methods is a problem. Because the way building will be built is dependent on the construction stage, hence input from the contractors is necessary for these decisions. Otherwise, the construction could be resulted in cost overruns and time delays.

Realize line: this duration and stage is much shorter than traditional stages because of constructor contributions and its construction knowledge in the early design phase.

Integrated project delivery system, its types, advantages and disadvantages and its principles will be discussed more in detail in section 2.6.

2.5 Considerations in selecting a delivery method

We couldn't say that there is one and only delivery method which could be used for any type of project with different size and conditions. Prior to anything, the owner could gather a consultant firm to decide on which kind of delivery method is the best response to its project. However, here are four main systematic problems that still remain with the traditional delivery methods. This four is listed as, good ideas are held back, contracting constrains the cooperation and innovations, coordination is not supported and there is a pressure for local optimization (Matthews & A.Howell, 2005).

2.5.1 Owner's requirements and risk considerations

There are several areas of concern for owner related to this title

2.5.1.1 Budget

“Determining realistic budget before design is a tool

1. To Evaluate project feasibility
2. To Ensure financing
3. To Evaluate risk

4. Budget is a tool to choose an appropriate design alternative
5. Budget is a tool to choose an appropriate site location alternative”

After the budget determined; owner attempts to finish the project at or near to the established budget.

2.5.1.2 Design

The design team should be well qualified in order to design a facility which fulfills the needs of the owner and users. Also owner must ensure that program needs are clearly conveyed to the designer. It would be worth noting that the designed facility not only should be viable, but also the purpose of the project should be clearly communicated between the owner and the designer.

2.5.1.3 Schedule

The schedule is almost similar to the design, dates like design commencement, construction completion and the operation of new facilities could be critical not only in virtue of generating revenue from the facility but also in terms of providing desired functional space by determining deadline.

Therefore, realistic schedule consisting of project duration and sequencing is absolutely vital for the project. It should be embodied early in the planning, afterwards the schedule must be monitored and updated throughout all phases of the project.

2.5.1.4 Risk assessment

Risks are tied to issues like local construction market, safety, the schedule, and the budget. The owner should have a precise understanding of construction risks, meanwhile, he allocates related risk to the appropriate party with higher consciousness.

2.5.1.5 Owners level of expertise

In general owner's familiarity with construction process, experience and expertise, level of in-house management capability is very important. Also owners should make a precise assessment of their performance ability under each delivery method.

2.6 IPD as a new delivery method

Some studies carried out in the Middle East coastal countries and mainly in oil and gas construction industry remarks that the contractor and subcontractor should be involved in early design phase but this approach rarely happens. Modified FIDIC red book contracts prevent contractor to participate in early stages of the project (Al Subaih, 2015). FIDIC, also, gives the authority to owner; therefore the contractors highly likely to protest and claim against the will of the owner. Almost eighty percent of claims need to be referred to arbitration or litigated in the court. It is because the contract is prepared by the owner according to the Modified red book of FIDIC and submitted to the contractor. So, in this type of contract high level of risk is imposed upon the contractor and also constructor's capacities have been neglected. The most outstanding root cause of issues is lack of trust. The cultural matters are of utmost importance and so the necessary modifications and justifications need to be implemented. (Rached, Hraoui, Karam, & Hamzeh, June 2014).

2.6.1 What is IPD

As an introduction to alliance systems; Technology advancements can greatly inspire the owners to help the development of Alliance system and thereby to aspire for much better, faster, less costly and less adversarial construction projects.

If the world of IPD wants to be summarized, it may be listed like below

- I. All participants such as, facilities managers, end users, contractors and suppliers are all involved at the start of the design process
- II. Decisions are not made on cost basis, mostly based on qualification

- III. Communications are clear, concise, open, transparent, and trusting
- IV. Designers are knowing the ramification of their decisions and its effect on the project from the time the decisions are made
- V. Risks and rewards are appropriately balanced and attached to all team members over the life cycle of the project
- VI. This environment is much better and sustainable for the industry and it gains a higher quality as well.

Regarding to utilization of IPD both knowledge and expertise could be leveraged
Productive and integrated teams are composed of key project participants, which are guided by principles of

- I. Trust
- II. Transparent process
- III. Effective collaboration
- IV. Open info sharing
- V. Team success tied to project success
- VI. Shared risk and reward
- VII. Value based decision making
- VIII. Utilization of full technological capabilities and support

Which resulted in an efficient design, build and operation. (AIA California Council, 2007)

The time saving and accelerated and intensified procedure of integrated project delivery is relatively obvious in *Figure 13*.

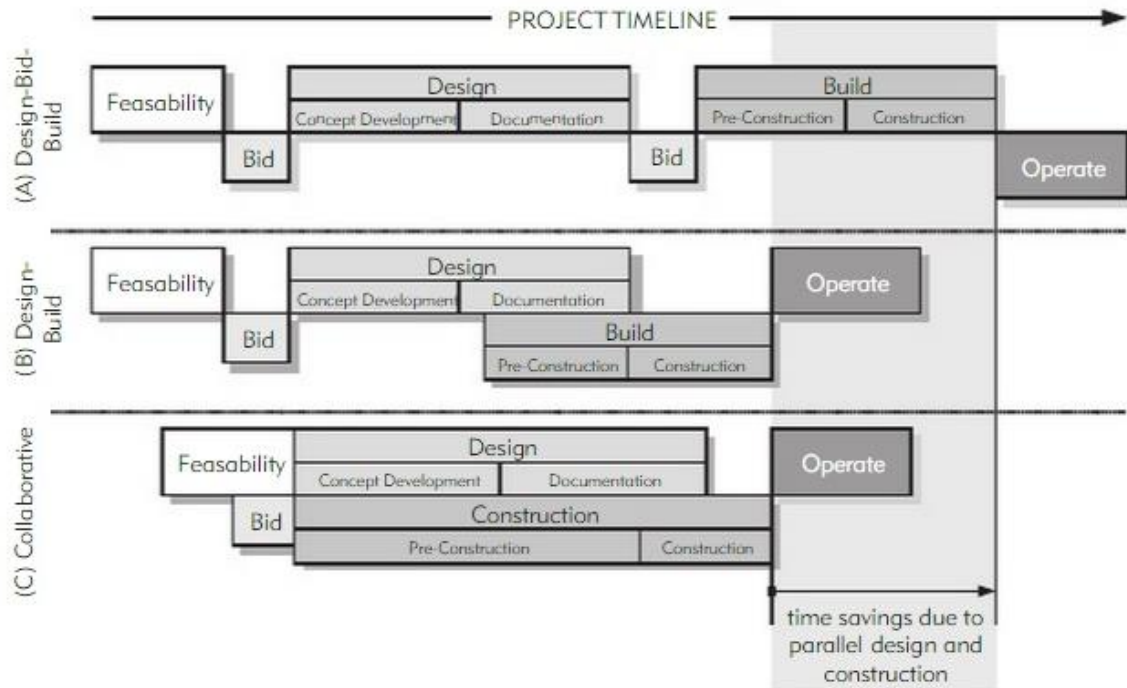


Figure 13. Time saving of IPD (Eastman, Teicholz, Sacks, & Liston, 2008)

2.6.2 Types of IPD

IPD can be implemented on three levels, in level one it is only considered as a philosophy and there is a typical collaboration but not organized Implementation. At level 2, there is more tendency to apply the elements of IPD and the collaboration is enhanced. Finally, in level3, IPD is completely implemented as a delivery system of the project (Table 6).

Table 6. Levels of Collaboration (The Associated General Contractors of America, 2010)

	Level One “Typical” Collaboration	Level Two “Enhanced” Collaboration	Level Three “Required” Collaboration
<i>Level of Collaboration</i>	Lower		Higher
<i>Philosophy or delivery Method?</i>	IPD as a Philosophy	IPD as a Philosophy	IPD as a Delivery Method
<i>Also known as...</i>	N/A	IPD-ish; IPD Lite; Non Multi-party IPD; Technology Enhanced Collaboration; Hybrid IPD; Integrated Practice	Multi-Party Contracting; “Pure” IPD; Relational Contracting; Alliancing; Lean Project Delivery System™
<i>Delivery Approaches</i>	CM at-Risk or Design-Build	CM at-Risk or Design-Build	Integrated Project Delivery
<i>Typical Selection Process</i>	Qualifications Based Selection of all team members or Best Value Proposal	Qualifications Based Selection of all Team members	Qualifications Based Selection of all team members
<i>Nature of Agreement</i>	Transactional	Transactional	Relational
<i>Key Characteristics</i>	No contract language requiring collaboration Limited team risk sharing CM or DB share in savings	Contract language requiring collaboration Some team risk sharing Co-location of team	Owner-Designer-Contractor (and possibly other key team members- IPD Subs) all sign one contract that contracts collaboration Team risk-sharing-incl. A/E Team decision-making Optimizing the Whole Pain / Gain sharing Limits on litigation Co-location of the team
<i>Typical Basis of Reimbursement</i>	GMP	GMP	GMP or No GMP (some costs guaranteed)

2.6.3 Advantage and disadvantages of IPD

The first aim of IPD is to reduce waste and inefficiency in AEC. The waste amount in the construction industry is very high as presented below:

- I. ECONOMIST article from 2000 identifies about 30% waste in the US construction industry (AIA California Council, 2007)
- II. NIST study from 2004 decelerates that lack of AEC software interoperability causes to about \$15.8 B cost overrun annually (National Institute of Standards and Technology , 2004); (Fallon & Palmer, 2007)
- III. US Bureau of Labor Statistics study shows that there is a decrease in productivity in the construction industry since 1964 while other non-farm industries have increased productivity by 200% (Teicholz, 2004).

Also emerging technologies (like building information modeling) in conjunction with the collaboration process (like integrated project delivery) are able to increase productivity and decrease Request for Information (RFI), field conflicts and waste. What's worth mentioning here is that ASHRAE (American Society of Heating, Refrigerating and Air-conditioning Engineers), LEED (Leadership in Energy and Environmental Design) by USGBC (United States Green Building Council), and UKOGC (United Kingdom Office of Government Commerce) endorsing collaborative systems are energy efficient.

2.6.4 Benefits of IPD for Main Stakeholders

The benefits of embracing IPD are listed below for all stakeholders of a project.

- Owners

- I. IPD strengthens the project team's understanding of the owners desired outcomes
- II. Improve ability of team for cost control
- III. Project goals (schedule, life cycle costs, quality, and sustainability) will be achieved

- Constructors

The contribution of their experience in construction early in design phase would increase project quality and financial performance. As a result;

- I. Strong pre construction planning
- II. More timely and informed understanding of design
- III. Anticipating and resolving design related issues
- IV. Visualizing construction sequencing prior to construction
- V. Improving cost control, will be achieved.

- Designers

- I. Benefit from early contribution of contractors' expertise during design phase such as accurate budget estimations and pre construction solutions to design related issues which may result in much better project quality and financial performance
- II. IPD increases the level of effort during the early design phase, but reducing documentation time, improve cost control

IPD based on the trust of different parties. In other words, the Integrated Project Delivery system is a trust-based system and totally depends on the working culture of a country. So that, reliability and trust between participants is a controversial and unsolved issue for the subject.

2.6.5 IPD principles

There are two types of principals in correlation with integrated project delivery; the first group is contractual principles and the second group is behavioral principles.

The first group is contractual principles consist of holding all stakeholders in at the same level and bind them together, relating the risk and reward of each participant to the outcome of the project, liability of parties, process transparency, early involvement of key participants and collaborative decision making for target of the project.

The second group of principles, namely behavioral principles, consists of three major principles as; mutual respect and trust, willingness to collaborate and open information sharing and communication (AIA California Council, 2007).

All elements of these two groups are listed below with a short definition for them. Afterwards, the table of principles citation among literature will be provided.

1. Mutual Respect and Trust

All of the parties understand the value of collaboration and are committed to working as a team in the best interest of the project.

2. Mutual Benefit and Reward

All participants benefit from collaboration. One of the fundamental requirements of integrated processes, is early involvement of key participants. Compensation Structure and system of IPD recognize and reward early involvement. The compensation system of IPD is based on “what’s best for project” behavior, so achieving project goals resulting in rewarding.

3. Collaborative Innovation and Decision Making

Innovation is accelerated because of brainstorming among all participants in an integrated project acceptance of ideas are dependent on their merit, not on the author’s role or status.

Key decisions are evaluated by a team and made unanimously.

4. Early Involvement of Key Participants

Parties are involved from the earliest practical moment

Decision making is improved by the influx of knowledge and expertise of key participants.

The key participants could be able to apply their own combined knowledge and expertise in the early stages of a project where they are very effective and powerful.

5. Early Goal Definition

Project goals are defined, agreed, developed and respected by all participants.

6. Intensified Planning

The most effort of IPD is focused on the principle that increased effort of planning is equal to efficiency improvement together with execution savings

Moreover; increased design effort resulted in increased design results, streamlining and shortening the expensive construction effort.

7. Open Communication

IPD is based on open, direct, and honest communication among all participants

Responsibilities are clearly defined

- There is a no-blame culture to directly address the root of problems
- As soon as disputes occurred; they promptly get resolved according to this system

8. Appropriate Technology

- IPD relies on cutting edge technologies
- This technology is defined in specified in earlier staged of projects to maximize efficiency

9. Organization and Leadership

- Leadership is given to the most merit and most capable member according to work or service
- Often; design professionals and contractors lead in areas of their own expertise.

Table 7. IPD principles in literature

1	Mutual respect and trust	(AIA California Council, 2007) (Munakami, 2012) (The Associated General Contractors of America, 2010) (Mihic, Sertic, & Zavrski, 2014) (Amirarjmandi, Eghtedari, & Mazaheri, 2011) (Ghassemi & Becerik-Gerber, 2011)
2	Mutual benefit and reward	(AIA California Council, 2007) (Munakami, 2012) (The Associated General Contractors of America, 2010) (Mihic, Sertic, & Zavrski, 2014) (Becerik-Gerber, Kent, & DDes. , 2009) (Becerik-Gerber & Kent, 2010) (Amirarjmandi, Eghtedari, & Mazaheri, 2011)
3	Collaborative innovation & decision making	(AIA California Council, 2007) (Munakami, 2012) (The Associated General Contractors of America, 2010) (Mihic, Sertic, & Zavrski, 2014) (Ghassemi & Becerik-Gerber, 2011)

4	Early involvement of key participants	(AIA California Council, 2007) (Munakami, 2012) (The Associated General Contractors of America, 2010) (Mihic, Sertic, & Zavrski, 2014) (Becerik-Gerber, Kent, & DDes. , 2009) (Becerik-Gerber & Kent, 2010) (Amirarjmandi, Eghtedari, & Mazaheri, 2011) (Ghassemi & Becerik-Gerber, 2011)
5	Early goal definition	(AIA California Council, 2007) (Munakami, 2012) (Mihic, Sertic, & Zavrski, 2014) (Ghassemi & Becerik-Gerber, 2011)
6	Intensified planning and design	(AIA California Council, 2007) (Munakami, 2012) (The Associated General Contractors of America, 2010)
7	Open communication	(AIA California Council, 2007) (Munakami, 2012) (The Associated General Contractors of America, 2010) (Mihic, Sertic, & Zavrski, 2014)
8	Appropriate technology	(AIA California Council, 2007) (Munakami, 2012) (Mihic, Sertic, & Zavrski, 2014)
9	Organization and leadership	(AIA California Council, 2007) (Munakami, 2012) (Amirarjmandi, Eghtedari, & Mazaheri, 2011)
10	Multiparty agreement	(Becerik-Gerber, Kent, & DDes. , 2009) (Becerik-Gerber & Kent, 2010) (Ghassemi & Becerik-Gerber, 2011)

The principle table of IPD is very vital for this study. So to understand them deeply, it is necessary to consider and read the resources and articles which are mentioned in the table.

2.6.6 Challenges to IPD – Opportunities to IPD

The fundamental information which was given in the section 2.4 is about main three delivery methods. Thereupon, in this section the chances and the challenges of main three traditional methods will be discussed. As a brief glance, the Table 8 has been generated (AIA California Council, 2007). The literature overwhelmingly accepts that CM@R is the most suitable one for IPD.

1- Challenges and opportunities of DBB to IPD

This system has the minimum chance to synch with IPD because it does not permit to the early involvement of constructor in the design phase. As a challenge to IPD, because of the rigid structure of DBB, it provides the minimum possibility of integration. Sometimes contractor involvement after design accomplishment is an obligation. On the other hand, the principles of these two system are conflicting with each other. But there is opportunity for improving this issue, for instance, the owner and the architect could articulate their desire in recall for bid documents that an integrated approach will be employed. Thereby, the owner and architect could bid in early stage and benefit from the constructor's constructability experiences.

2- Challenges and opportunities of DB to IPD:

This system has middle chance to synch with IPD. As opportunities to IPD, DB is suitable to change to IPD, because the designer and constructor are employed at the same time in the early stages, so main principles of IPD are applicable from the start. The owner, also, could take part in and collaborate with a designer and constructor. As challenges to IPD, first of all more contributions of owner is essential to IPD and must be considered in the owner/designer-builder agreement. Owner should change compensation model to incentive model for design – build team. Options like, target cost establishment, GMP elimination and using open book accounting for project costs foster owners collaboration in the project. Standard agreements of

design-build could be easily changed and transferred to IPD, but the roles and scope of services of each party should be defined clearly.

3- Challenges and opportunities of CMR to IPD:

Most suitable one to IPD adaptation. As opportunities to IPD; this delivery method satisfies “early involvement of key participants” principle of IPD. If the constructor considered as Constructor Manager, Key participants and the constructor will participate in the project in early stages. CM@R is appropriate for public and private projects, on which budget and schedule be monitored and collaboration of the designer and contractor is obliged. As challenges to IPD; in this system separate agreement should be conducted. So, this issue isn’t in the same line with IPD principles. Therefore, in order to control this separate agreements, owner has to prepare another agreement to control parties’ behavior (*Table 8*).

Table 8. Opportunity and Challenges of Delivery Systems to IPD

	DBB	DB	CM@R
Challenges to IPD	Most	Middle	Less
Opportunities to IPD	Less	Middle	Most

2.7 BIM

As an introduction and definition of Building Information Modeling (BIM), the glossary of the BIM handbook defines BIM as “a verb or adjective phrase to describe tools, processes, and technologies, that are facilitated by digital machine-readable documentation about a building, its performance, its planning, its construction, and later its operation” (Eastman, 2008).

“A Building Information Model is a digital representation of the physical and functional characteristics of a facility. A Building Information Model is a shared knowledge resource for

information about a facility, forming a reliable basis for decisions during its life-cycle, defined as existing from earliest conception to demolition” (Eastman, Teicholz, Sacks, & Liston, 2008). A basic premise of Building Information Modeling is collaboration by different stakeholders at different phases of the life cycle of a facility to insert, extract, update or modify information in the Building Information Modeling to support and reflect the roles of that stakeholder (Smith, 2006).

The most concise yet appropriate description of Building Information Modeling can be: “Building Information Modeling is the management of project information both the construction of that data and the iterative process of exchanging it” (Eastman, Teicholz, Sacks, & Liston, 2008). Building Information Modeling is adding intelligence to project data that allows anyone to interpret that data correctly, removing the risk of assumptions. Building Information Modeling is the process by which the right information is made available to the right person at the right time.

Many of previous case studies, evidence that BIM usage makes the construction process effective and efficient (Khanzode, Fischer, & Reed, 2008); (Manning & Messner, 2008); (Kaner, Sacks, Kassian, & Quitt, 2008). Also, parallel to this study, a couple of research papers, conduct the surveys in order to determine the value of BIM contribution to construction industry in different countries (El-Mashaleh, 2006); (Rivard , 2000); (Howard, Kiviniemi, & Samuelson, 1998); (Samuelson, 2008).

The most extraordinary aspects of BIM are the visualization of form, construction visualizations and clash detection capability. Also BIM adds value to stakeholders by decreasing g costs and increasing benefits (Becerik-Gerber & Rice, 2010).

As shown in Figure 14, BIM could model all of electrical, mechanical and construction drawings. Then clash points are determined by putting them together.

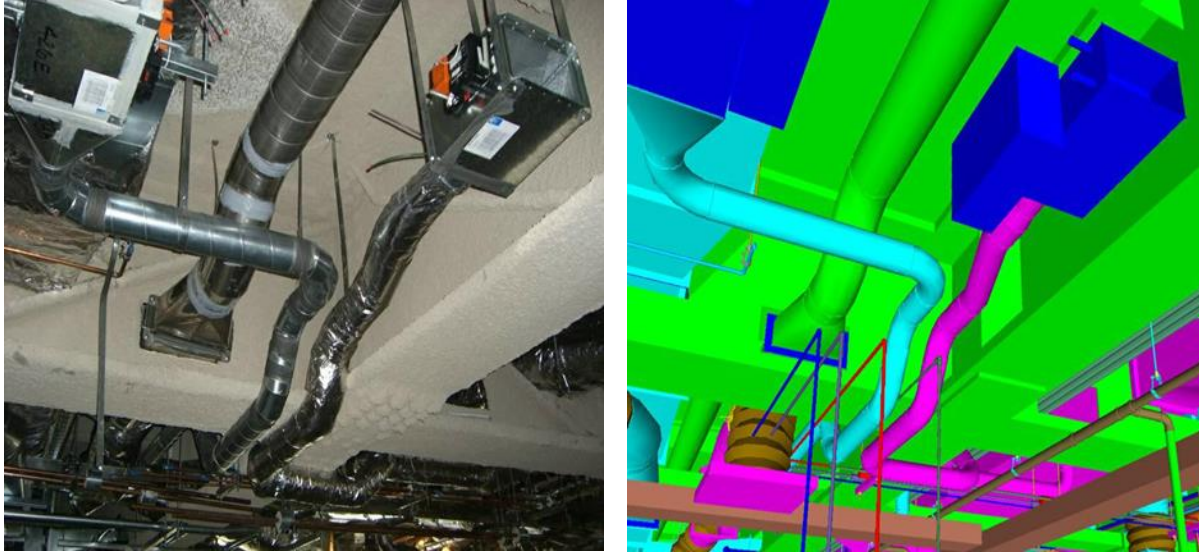


Figure 14. Visualization of form and clash detection with BIM - taken by the researcher of this study- previous work experience

2.7.1 BIM principles

Like many of other headlines and subjects in construction engineering and management, Building Information Modeling has its own principles. The most well-known and the most iterated principles in literature are listed below:

- 1- Visualization of Form (For Aesthetic and Functional Evaluation)
- 2- Rapid Generation of Multiple Design Alternatives
- 3- Use of Model Data for Predictive Analysis of Building Performance
- 4- Maintenance of Information and Design Model Integrity
- 5- Automated Generation of Drawings and Documents
- 6- Collaboration in Design and Construction
- 7- Rapid Generation and Evaluation of Construction Plan Alternatives
- 8- Online Electronic Object-Based Communication

Some of the references and citations are listed and generated as a table which take place herewith while identifying these BIM principles (Table 9).

Table 9. BIM principles in literature

Principle	References
Visualization of form	(Clemente & Cachadinha, 2013) (Sacks, Koskela, A.Dave, & Owen, 2010)
Rapid generation and evaluation of multiple design alternatives	(Clemente & Cachadinha, 2013) (Sacks, Koskela, A.Dave, & Owen, 2010)
Rapid generation and evaluation of multiple construction plan alternatives	(Clemente & Cachadinha, 2013)
Maintenance of information and design model integrity	(Clemente & Cachadinha, 2013) (Sacks, Koskela, A.Dave, & Owen, 2010)
Automated generation of drawing and documents	(Clemente & Cachadinha, 2013) (Sacks, Koskela, A.Dave, & Owen, 2010)
Collaboration in design and construction	(Clemente & Cachadinha, 2013) (Sacks, Koskela, A.Dave, & Owen, 2010)
Online/electronic object-based communication (plan and control)	(Clemente & Cachadinha, 2013) (Sacks, Koskela, A.Dave, & Owen, 2010)
Coordination in design and construction	(Clemente & Cachadinha, 2013)

2.8 BIM AND IPD

These two subjects are the relatively emerging headlines for construction management. While, each of which could be applied to the project separately and distinctly, they can leverage each other if both employed at the same time (Ilozor & Kelly, 2012).

Although it is possible to achieve IPD without BIM, it is the strong recommendation of this study that BIM is extremely essential for IPD to boost efficiency, synergy and collaboration (AIA California Council, 2007). Moreover, the literature has been synthesized and achieved that the best way to enhance collaboration and cooperation is the use of integrated project delivery system as delivery method, building information modeling as tool, lean construction as process together with sustainable construction principle. Therefore, most ideal way to achieve IPD is Combination of all new technologies e.g. BIM, LEAN, Sustainability (Figure 15). However, given the scope of this research, synchronization of BIM and IPD merely will be discussed. However, further studies of synthesizing the effects of these four concepts of the project process are strongly recommended.

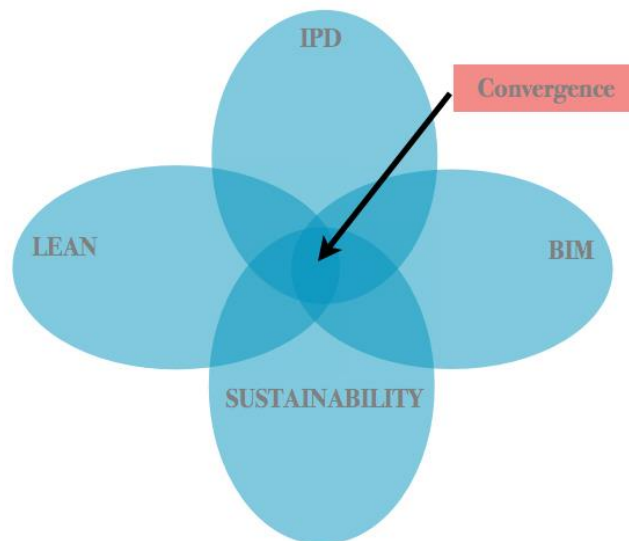


Figure 15. IPD - BIM - LEAN- SUSTAINABILITY convergence

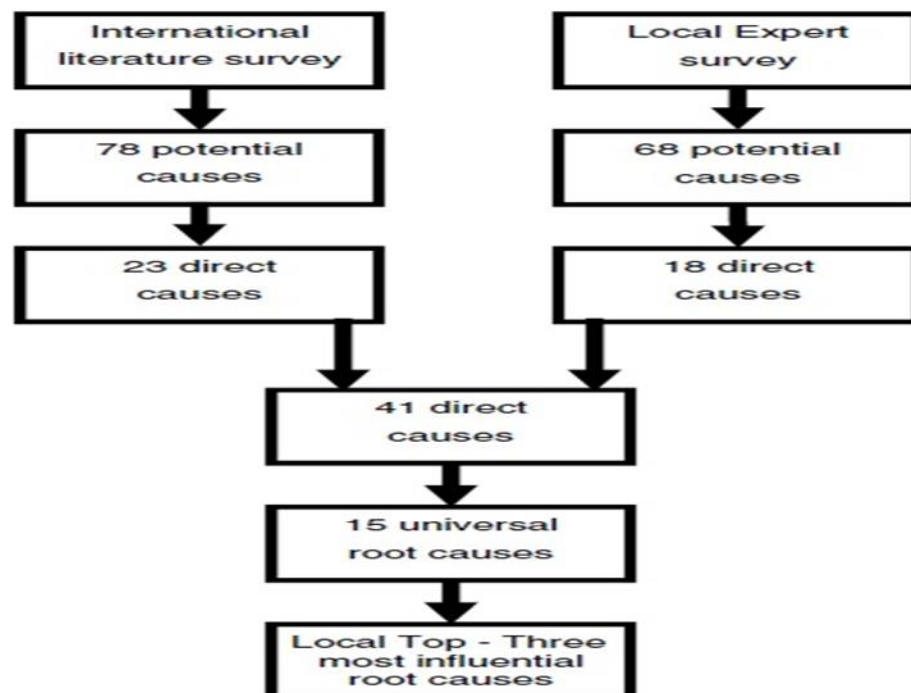
As mentioned previously, the interaction and the impact of each feature of BIM functionality on each IPD principle was assessed according to their definitions and wide synthesis of literature (Sacks, Koskela, A.Dave, & Owen, 2010). Overall assessment and obtained table provided below (Table 10).

Table 10. BIM –IPD interconnections and synergies identified

	1	2	3	4	5	6	7	8	9
	Mutual respect and trust	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
1 Visualization of form			X		X	X	X	X	
2 Rapid generation and evaluation of multiple design alternatives		X	X	X	X	X		X	X
3 Rapid generation and evaluation of multiple construction plan alternatives		X	X	X	X	X		X	X
4 Maintenance of information and design model integrity	X			X	X		X	X	X
5 Automated generation of drawing and documents				X	X	X		X	
6 Collaboration in design and construction		X	X	X	X	X	X	X	X
7 Online/electronic object-based communication (plan and control)	X	X	X	X	X	X	X	X	X
8 Coordination in design and construction	X	X	X		X	X	X	X	X

How does the binary combination of BIM and IPD enable parties to prevent unwanted cost overruns? Rosenfeld et al. (2014) conduct a survey implementing the results of local experts' researches in conjunction with international literature studies. Consequently, a certain number of potential causes were discovered. Thereafter, by categorizing, filtering and merging similar or closely related causes, he eliminated some of them. As a result, overall 41 direct causes were determined, from which some had been deleted via extracting and refining distinct independent root causes. Finally, 15 universal root causes were achieved. Amongst these 15, three root causes were considered vital (Table 11).

Table 11. Root-Cause Analysis of Construction Cost Overruns (Rosenfeld, 2014)



According to our discussion subject Integrated Project Delivery Method in conjunction with Building Information Modeling enables construction companies, owners, and any other related parties to eliminate about eight of this fifteen root causes and at least two of three vital root

construction cost-overflow causes. For instance the main three ones are; 1. Premature tender documents, 2. Too many changes in owners' requirements or definitions, and 3. Tender-winning prices are unrealistically low. In our suggested system, combination of BIM and IPD directly omit cause number 1 and 3 because in collaborative and integrated bidding method there is no tender available.

As other causes listed in Figure number 8, this binary combination would affect directly or indirectly the earmarked causes (Table 12) (Rosenfeld, 2014).

Table 12. BIM and IPD can effectively solve a number of main construction cost overrun causes (Rosenfeld, 2014)

The 15 Universal Root Causes with the Respondents' Answers					
Number	Cause	Number of votes	Percentage	Rank order	Original sequence before randomization
1	Premature tender documents (drawings, bill of quantities, specifications, contracts and legal documents)	169	86.7	1	10
2	Insufficient information about ground conditions	56	28.7	7	9
3	Too small a design budget	63	32.3	6	3
4	Force majeure (strikes/weather/regulation changes/accidents, etc.)	10	5.1	15	15
5	Too many changes in owners' requirements or definitions	139	71.3	2	12
6	Late start of the planning process, and with too low a budget	56	28.7	7	6
7	Insufficient, unstandardized owner's brief	70	35.9	5	14
8	Shortage in high-quality management personnel	53	27.9	9	1
9	Culture of conflicts and lack of trust	35	17.9	11	4
10	Unconstructable design	31	15.9	13	13
11	Tender-winning prices are unrealistically low (suicide tendering)	127	65.1	3	7
12	Lack of standard requirements from designers and poorly enforced professional liability of designers	33	16.9	12	8
13	Unclear, ambiguous, and contradicting terms in the tender documents	75	38.5	4	11
14	Unbalanced distribution of risk between owner and contractor	42	21.5	10	2
15	Unclear division of responsibilities and lack of clear requirements for professional management	16	8.2	14	5

2.9 The Role of the Construction Manager

Another factor which is very important to select a delivery method is the existence of a CM. Because there are trade-offs with various delivery methods, CM gives the owner, professional advice about the pros and cons of each method. CM also assists owner to make decisions, handle inquiries, and manage other processes quickly.

2.10 Contracting Alternatives

There are three main types of contracting and compensation alternatives. Each of them will be discussed below

2.10.1 Fixed Price/Lump Sum (LS)

Lump Sum (LS) contracting could be defined as “to perform fixed scope of works in exchange for an agreed lump sum payment” (The Construction Management Association of America, 2012). The Importance of Integrated Project Delivery system also highlighted by comparing it with lump sum contracting. The offshore oil and gas investigations in the Middle East region reveals that;

- 61% of Alliance (IPD) projects exceeded expectations versus 17% of non-Alliance projects
- 72% of Alliance (IPD) projects achieved lower cost than initial target/budget
- 36% of Alliance (IPD) projects were ahead of schedule compared with 10% for non-Alliance projects
- The best Alliance was 35% ahead of schedule while the best non-Alliance was 10%.

(Reilly, 2011).

Table 13 compares lump sum and alliance contracting methods. The lump sum contract represents the traditional delivery methods characteristics. On the other hand, alliancing contract methods stand for Integrated Project Delivery method. It is clear that lump sum contracting method causes adversarial relations. Also, in this method, collaborative team work is totally overlooked.

*Table 13. A brief comparison of key features of Lump sum and IPD contracting methodologies
(The Construction Management Association of America, 2012)*

Feature	Lump sum	Alliance contracting
Risk	Transferred to the Contractor	Shared between Alliance members
Cost	Total project cost is known at the time of contract award	Total project cost is not certain at the time of contract award
Time	The project delivery time is fixed	Project delivery time is not certain at the time of contract award
Relationship	Adversarial and Transactional	Trust and Teamwork
Dispute Resolution	Prescribed	No provision in the contract
Litigation option	Yes	Yes, but in very exceptional circumstances
Obligations	Individual	Collective
Cost overruns	Contractor	Born by project owner when above agreed threshold Shared amongst participants when below agreed threshold
Attitude	It is their project	It is our project
Contractor(s) selection	Competitive tender	No commercial competition per say, but costs are independently verified
Pre-project costs	From low to high, depending on pretender preparation (FEED etc.)	High to set up the alliance

2.10.2 Guaranteed Maximum Price (GMP)

To perform fixed scope of works in exchange for a price that is guaranteed not to exceed a stated maximum price

2.10.3 Reimbursable

To perform the fixed or varied scope of works in exchange for a payment based on some agreed calculation method and to not exceed maximum price

The Table 14 illustrates the most used contracting methods, namely traditional delivery systems and IPD. The most common contracting method for alliance systems is reimbursable. Because compensations totally depend on project outcome.

Table 14. Contracting methods of project delivery systems (The Construction Management Association of America, 2012)

Project Delivery Method Contracting Method	DBB	CMAR	DB	IPD
Lump Sum	Common	Common	Common	Rare
GMP	Rare	Common	Common	Rare
Reimbursable	Rare	Rare -Common	Rare	Common

2.11 Procurement Alternatives

To address this issue, there are two ways, price based or qualification based. Also, a combination of these two could be considered as a third way. In addition, procurement may involve one-step process or two-step process. That is, single round submittals for single round and qualification submittals before price proposals for a two-step process. As it is clear in Table 15 the qualification submittals are always the most important requirement from the owners' point of view.

Table 15. Procurement alternatives (The Construction Management Association of America, 2012)

Selection Criteria Project Delivery Method	Low Bidder (Selection Is Based Solely On Price)	Best Value (Selection Is Based On A Weighted Combination Of Price And Qualifications)	Best Qualifications (Selection Is Based Solely On Qualifications)
DBB	Most Common	Common; Price Evaluation Based On Construction Cost	Rare
CMAR	Rare	Most Common; Price Evaluation Based On CMAR Fees And General Conditions	Common
DB	Common	Most Common; Price Evaluation Based On Fees And General Conditions; May Or May Not Include Construction Costs	Common
IPD	Rare	Common	Most Common

CHAPTER 3

RESEARCH METHODOLOGY

The methodology of this study is based upon developing a procedure in order to collect data about principles, success factors and obstacles for acceptance such as economical, legal, cultural factors in Turkey and the Middle Eastern countries. The main purpose of this thesis is:

- To discuss the attitude of AEC industry members toward Integrated Project Delivery Method
- To compare the obtained results with similar previous studies.
- To outline correlations between various factors.
- To find suggestions for acceptance of this method in the region.
- To explain and compare the results in a quantitative manner.

The procedure contains of five main steps. First of all a broad literature review have been done in order to find the main success factors and the main obstacles to acceptance of IPD. Investigated previous similar studies had been carried out in different countries, therefore it was expected that the culture, economic conditions and legal systems will be differing in the region. Then the questionnaire questions had been designed. For beginning about 54 question have been designed and it has sent to a survey specialist from United State California University School of Engineering. This questionnaire, after first revision, was sent to another expert in Amirkabir University of Tehran. Afterwards, a final version is prepared by reviewing the comments. The final version was sent to industry members in Turkey and Middle Eastern countries. In the next step, the collected data analyzed by IBM SPSS software to quantify the results. Finally SPSS cross tabular calculations were performed to show the correlations between various factors. And then find the most reliable previous studies and compare them with our results and findings.

3.1 Step one: Identifying IPD main principles through literature review

By wide scanning in the literature more than 20 of main principles are defined. But after listing those with their importance in ascending order 4 of them eliminated. Afterwards by another precise literature skimming top ten were selected. These top ten is the most cited ones. The principles are listed as; Mutual trust – mutual reward- collaborative decision making- early involvement of key participants – early goal definition – intensified planning- open communication- appropriate technology – multi-party agreement.

The main previous works which the results compared to this study are:

- 4- (Guynes, 2011)
- 5- (Al Subaih, 2015)
- 6- (Becerik-Gerber & Kent, 2010)
- 7- (Rosenfeld, 2014)
- 8- (Amirarjmandi, Eghtedari, & Mazaheri, 2011)
- 9- (nejati, javidruzi, & mohebifar, 2014)
- 10- (Herrmann, Gregory, Miller, & Moss, 2013)
- 11- (Rached, Hraoui, Karam, & Hamzeh, June 2014)

3.2 Step two: Questionnaire study

As mentioned previously, after the wide range of literature study the first draft of questionnaire gets prepared.

3.2.1 Designing a questionnaire

The first draft had about fifty five questions, but after the first revision of expert from the USC University School of engineering and department of construction engineering and management, this number decreased to twenty eight questions. Unnecessary or irrelevant questions have been eliminated and one new question added to the questionnaire. Afterwards the questionnaire formatted to standard draft for our research aim in both English and Farsi. Afterwards, this draft was sent to second survey experts at the Shahid Beheshti university of Tehran in department of project management. Previous negotiations had been conducted at our

research before than sending a draft to him. In third step questionnaire provided to my advisor in Middle East Technical University and the last edition fixed by her. The Turkish draft prepared with the eminent contributions of my respectful adviser. Therefore the questionnaire gets ready to send in three languages.

3.2.2 Sending the questionnaire to industry members and experts in the MiddleEast

This survey had been sent to all members of industry members who mainly work in the governmental organizations, associations and chambers. The soft copy of the questionnaire (with instruction) had been mailed to and the hard copy of the questionnaire had been submitted to the organizations listed below:

- Public Procurement Agency (PPA) of Turkey (KIK)
- The Union of Chambers and Commodity Exchanges of Turkey (UCCET) – (TOBB)
- Turkish Contractors Association (TCA)
- Iranian Society of Consulting Engineers (IRSCE)
- Project Management Institute of Turkey (PMI TR)
- International Project Management Association (IPMA)’s both Iran and Turkey branches
- Chamber of Civil Engineers In Ankara (IMO)
- Tehran Construction Engineering Organization (TCEO)

This questionnaire, also, had been sent to the academic and related organizations. A couple of them listed herewith:

- Civil engineering departments and department of architecture of Turkish universities (such as Middle East Technical University- Istanbul Technic University – Eastern Mediterranean University - EGE University – Yildiz Technical University etc.)
- Civil and environmental engineering and department of architecture of Iranian universities (Tehran University – Shahid Beheshti University –Tarbiat Modarres university of Tehran - Tabriz University, etc.)
- Civil engineering department at Salahattin University College of engineering in Kurdistan-Iraq
- Department of civil engineering at Qatar University

And this form has been sent to construction companies which I had previous working experience with:

- Renaissance Construction Company –Gülan tower project (world trade center of Erbil), Erbil-Iraq
- Yenigün construction –integrated hospital project, Taif -Saudi Arabia
- Hidrokon consultants – Ankara- Turkey
- Karadeniz company- Tabriz desert irrigation and canalization project, Tabriz-Iran
- Jonub Sazeh company – Moghan desert irrigation and canalization project, Moghan-Iran

The form was sent to respondents three times on different dates by academic mail, company given private mail and a Gmail account. Besides, social media was very important part of this study, applications such as Viber, Whatsup, Line, Telegram, Skype and Tango and interfaces such as LinkedIn, Twitter, Facebook, and Google plus have been employed to connect and collect answers.

There was many of survey tools such as Google Forms, Survey Monkey, Qualtrics, Type Forms, Client Heartbeat, Zoho Survey, Survey Gizmo, Survey Plant, etc. But all of these tools had their own limitations like; limited number of respondents, limited number of questions, data export limitations, some of them is not free and do not let the researcher to add his own logo to the sheet, multi-language shortcomings, etc. Accordingly, Middle East technical university provided Lime Survey Service preferred. By academic mail address both the interface and the databases were available to researchers.

3.3 Step three: Carry out SPSS analysis with obtained data

The report contains information compiled from interviewed experts and online surveyed people. The data analyzed in this report was collected from Academicians, experts and AEC industry members. The people who contained in our scope of research were asked about their opinions and ideas about integrated project delivery.

Although the form had been sent to about 2300 industry members, only 379 of them attempted to answer the questions but they couldn't finish the questionnaire. Answering process and

period of participants has been tracked by a researcher. Therefore, the number of non-completed answers was about 16.43%. The number of those who able to complete the survey was 102. It means that only 4.43% of the participants responded back. In the table below (Table 16) the number of total respondents is shown in the first column, the number of non-completed answers is in the second and the number of test takers who answered to all of the questions is demonstrated in third demonstrated.

Table 16. Total, non-completed and completed answers

Results		Results		Results	
Number of records in this query:	379	Number of records in this query:	102	Number of records in this query:	277
Total records in survey:	379	Total records in survey:	102	Total records in survey:	277

A numerous methods are eligible for analysis the results such as SPSS, LISRE, EVIEWS, SMART PLS, AMOS, SAS, EQS, MICROFIT, MINITAB, EXPERT CHOICE, R test, Microsoft Excel. But the most prevalent one of our study is found to be the IBM SPSS. Therefore, the IBM SPSS Version 23 had been chosen for our research.

3.4 Step four: Finding correlations between collected data

IBM SPSS 23 allows user to find logical correlation between the variables. Tests which Could be carried out with numeric sets of data similar to ours are Anova, Manova, Ancova, Logistic Regression, alpha Cronbach, chi-square test, Choprof dependence coefficient, phi dependence coefficient, Pearson dependence coefficient, Cramer's contingency coefficient, Spearman's rank correlation coefficient, M.C. Nemar test, etc. According to our type of data (it is string, not a numeric data) the best result could be obtained with the chi-square test.

3.5 Step five: compare obtained results with previous studies

After completion of step four we proceed to step five. In step five, after wide review of the literature, the most reliable previous researches are recognized. The last results of this research are compared with our findings. There are two studies from the United States and one similar study from Lebanon. The comparisons between them reveals that there is cultural differences between the Mediterranean, the American and the Middle Eastern attitudes toward IPD. Bar Charts are prepared in M.S. Excel to compare them with previous result charts of researchers. Also, SPSS bar charts are employed to ensure the validity of M. S. Excel findings.

CHAPTER 4

FINDINGS AND ANALYSIS OF SURVEY RESULTS

As mentioned in section 3.5 the attitudes of the American, the Mediterranean and the Middle Eastern AEC industry members toward IPD are different. In the AEC industry of the Middle East region, about all of the industry members are suffering from the adversarial relations as well as cultural shortcomings. The table below (Table 17) reveals that team a working sprit is not completely stabilized in the region.

Table 17. Cultural shortcomings in the Middle East for IPD (Rached, Hraoui, Karam, & Hamzeh, June 2014)

Cultural Dimensions	Score
Future Orientation	Low
In-Group Collectivism	High
Uncertainty Avoidance	Low
Participative	Low
Team Oriented	Low
Self-Protective	High

4.1 Analysis of survey results

The questionnaire is developed to include 24 questions. The content of the survey is as follows:

- The first five questions are the demographics,
- Question six to twelve is for measuring IPD knowledge, will and success factors for IPD.
- Question thirteen to sixteen is related to information technology and BIM.
- Question seventeen to nineteen is for investigation IPD acceptance obstacles.
- Question twenty to twenty-two is for understanding industry trends.
- Question twenty-three and twenty-four are overall assessment about industry members' ideas toward the time and the percentage which would be occupied by IPD in the construction delivery market.

First of all respondents should click on one of three links which were sent to their mail address according to their language preference and when they complete the questionnaire the clicked responses had been recorded in the record sheet. Therefore, in this 3-D clustered column bar chart below (Figure 16. Selected language, completed and non-completed) two type of answers is counted. The red bars show the number of completed answers for those who answered all of questions and the blue bars are for the respondents who wanted to participate but did not completely answer all the questions.

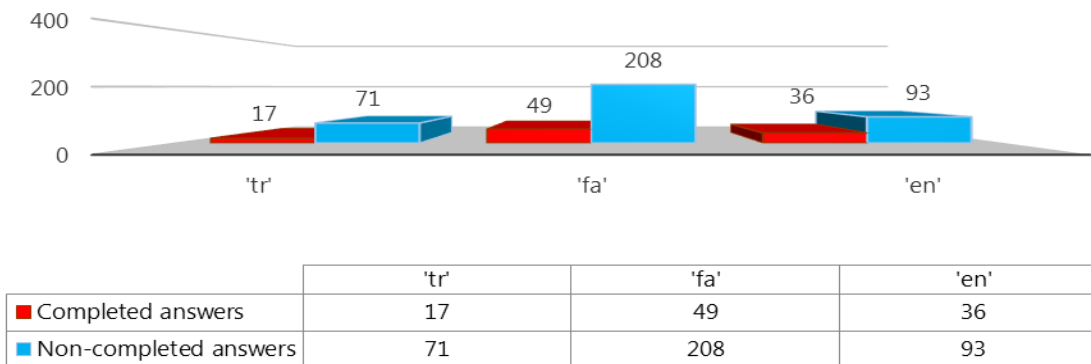


Figure 16. Selected language, completed and non-completed answer

4.1.1 Survey demographics

As shown in the Figure 17. Figure 17 majority of respondents (23.53%) holds degree of engineering and 19.6% works in general contracting firms. In a similar study of Rached et al. (2014) the majority of respondents (60%) are working in a contracting firm while 23% works in architecture or engineering firm. (Figure 18).

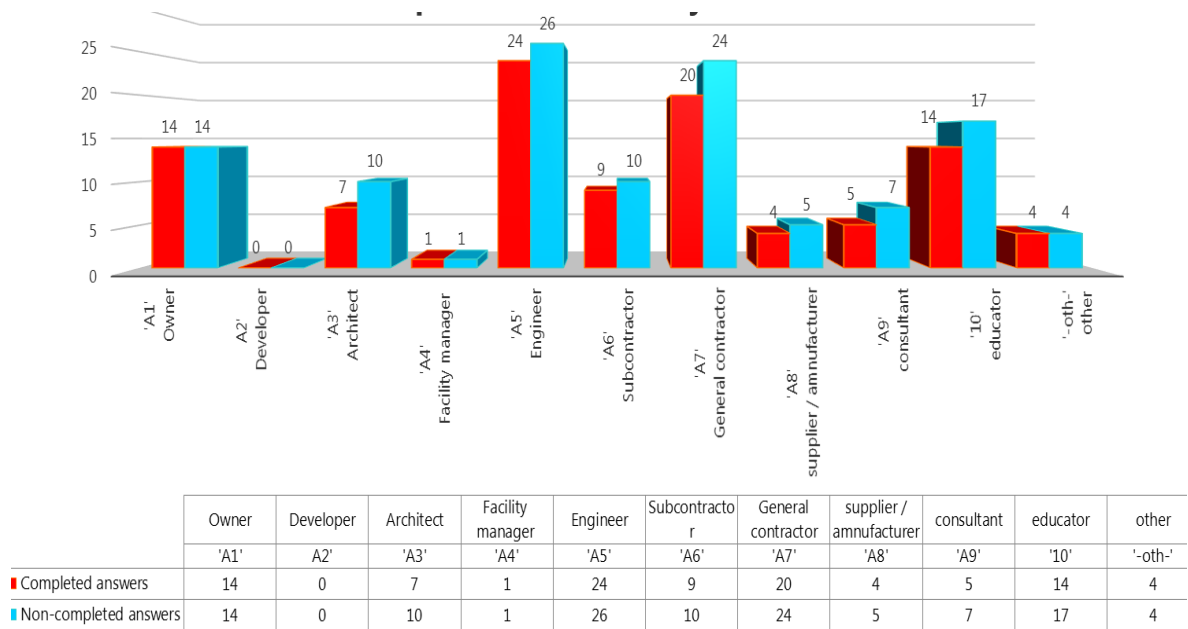


Figure 17. Role of Respondents in the industry

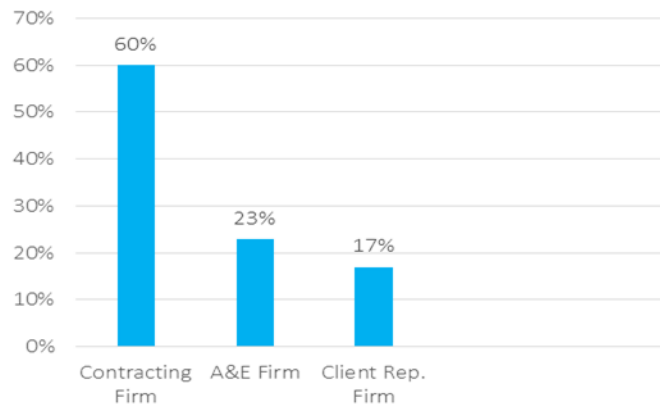


Figure 18. The nature of the firm to which they belong at present (Rached et al. 2014)

In Figure 19 Figure 20 the most affluence belongs to companies or organizations which their staff number is less than 50. The number of uncompleted answers is 50 out of 379 with the percentage of 13.19%. The number of completed answers is demonstrated in as 41 out of 102 with percentage of 40.19%.

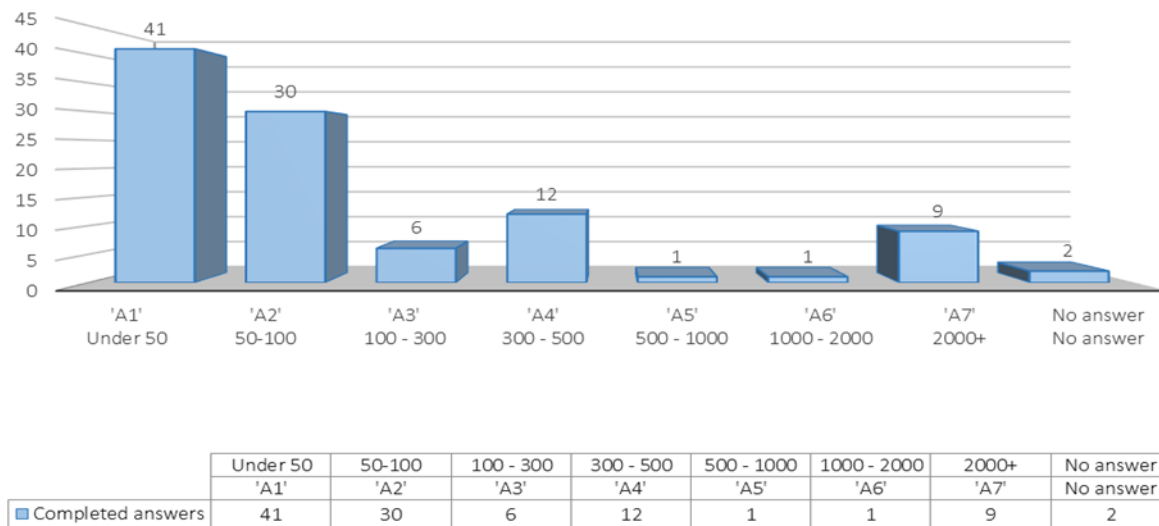


Figure 19.Total staff

In the next step participants were asked about their overall experience in the industry. Results reveal that the majority of respondents, 31.37% is belongs to five to nine years of experience in the industry (Figure 20) whereas the main majority of Rached et.al. Research belongs to people experienced more than 30 years in the sector (Figure 21).

The most important point the 3-D clustered bar chart shows is the relation between people who said they would like to work on projects with IPD system. In the other words, the chart illustrated that the experienced industry members absolutely agree with the implementation of integrated project delivery, while not all of the younger industry members are interested in IPD. It was expected that younger professionals would be more eager to accepting change and adopting new methods, but the results showed the experienced respondents were interested in IPD more than the others. This correlation is also verifiable with SPSS chi-square test. The result of the chi-square test shows 1.574 and this number verify the

high correlation between experience and eagerness to IPD implementation because that's smaller than 9.488. Therefore the H0 (null hypothesis) is accepted (Table 19).

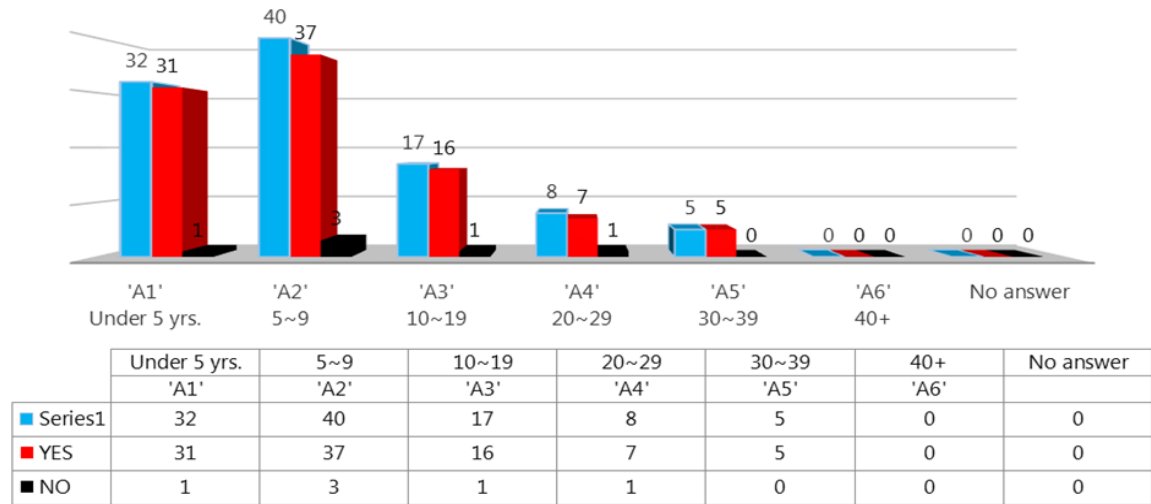


Figure 20. Experience of respondents and their eagerness to participate in IPD project

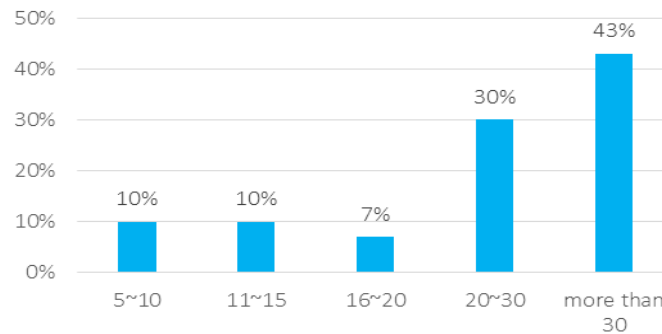


Figure 21. Distribution of the participants according to their overall years of experience (Rached et al. 2014)

Table 18. Critical values of chi-square distribution with ν degrees of freedom

Probability of exceeding the critical value					
ν	0.01	0.05	0.025	0.01	0.001
1	2.706	3.841	5.024	6.35	10.28
2	4.605	5.991	7.378	9.21	13.816
3	6.251	7.815	9.348	11.345	16.266
4	7.779	9.488	11.143	13.277	18.467
5	9.236	11.07	12.833	15.086	20.515
6	10.645	12.592	14.449	16.812	22.458
7	12.017	14.067	16.013	18.475	24.322
8	13.362	15.507	17.535	20.09	26.125
9	14.684	16.919	19.023	21.666	27.877
10	15.987	18.307	20.483	23.209	29.588

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Years of experience * INTERESTED TO IPD	102	100.0%	0	0.0%	102	100.0%

Years of experience * INTERESTED TO IPD Cross tabulation

			INTERESTED TO IPD		Total
			Yes	No	
Years of experience	Under 5 yrs.	Count	31	1	32
		Expected Count	30.1	1.9	32.0
	5-9	Count	37	3	40
		Expected Count	37.6	2.4	40.0
	10-19	Count	16	1	17
		Expected Count	16.0	1.0	17.0
	20-29	Count	7	1	8
		Expected Count	7.5	.5	8.0
	30-39	Count	5	0	5
		Expected Count	4.7	.3	5.0
	Total	Count	96	6	102
		Expected Count	96.0	6.0	102.0

Table 19 Chi-square test for correlation between experience and eagerness to IPD implementation

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	1.574 ^a	4	.813
Likelihood Ratio	1.793	4	.774
N of Valid Cases	102		

a. 6 cells (60.0%) have expected count less than 5. The minimum expected count is .29.

About 83% of whole test takers agreed that current delivery methods have non-negligible issues (Figure 22). As an example of this issue, according to Rached et al (2014) about 53% of all respondents agreed that FIDIC red book contracts in traditional delivery methods favors claims. The same study, also, illustrated that the level of satisfaction with the FIDIC red book is relatively small. 45% of participants dissatisfied and 14% of them very dissatisfied with this type of contracts. Therefore more than half of the test takers dissatisfied with the current delivery method. As another example, also, 53% agree that FIDIC red book contracts are claim prone (Figure 23).

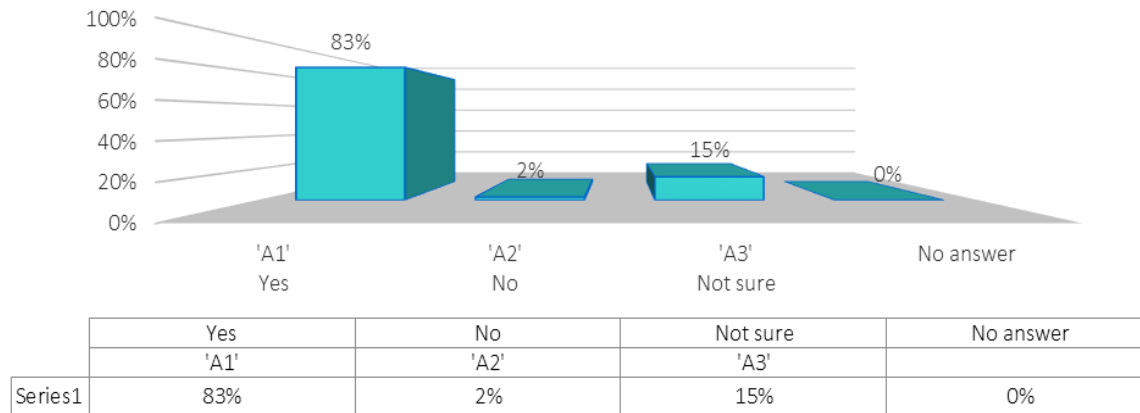


Figure 22. Do the current delivery methods incorporate any issues?

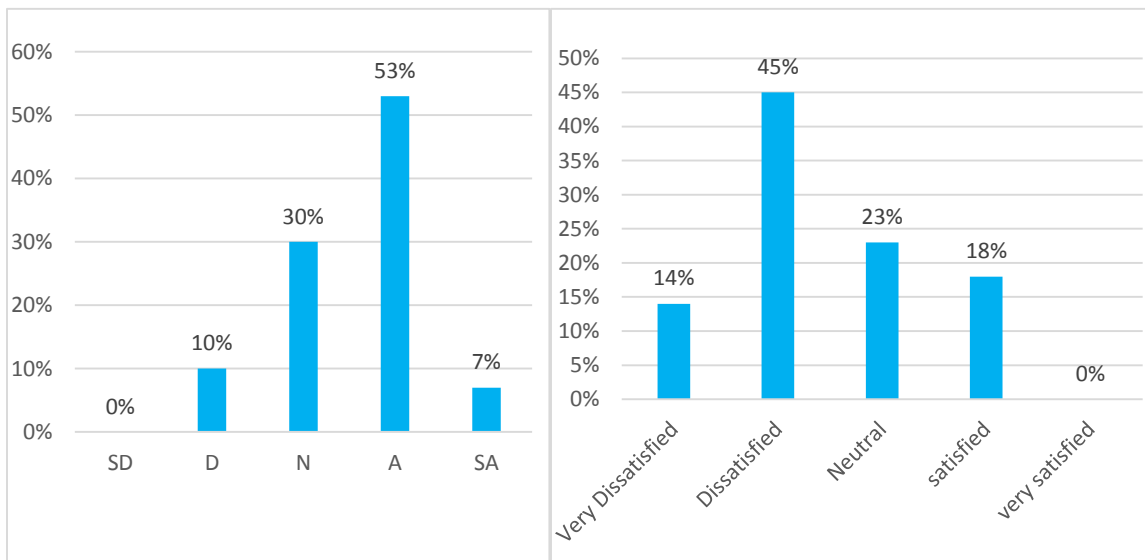


Figure 23. Left-the percentage of contractors who tend to claim. Right- the level of satisfaction with FIDIC (Rached et.al. 2014)

In the other comparison of our study with some other studies, when we adapt our data according other studies, it brings about some notifiable results. It means that respondents divided into two main groups as informed and experienced with IPD. As shown in the

figure below (Figure 24) 81.8% of experienced people in the Middle East concede that delivery systems hold issues in the Middle East. Similarly, 68.2% of American experienced participants claimed unsatisfied with traditional delivery options. . Comparing these data once again highlights the efficiency of collaborative systems in comparison with traditional methods.

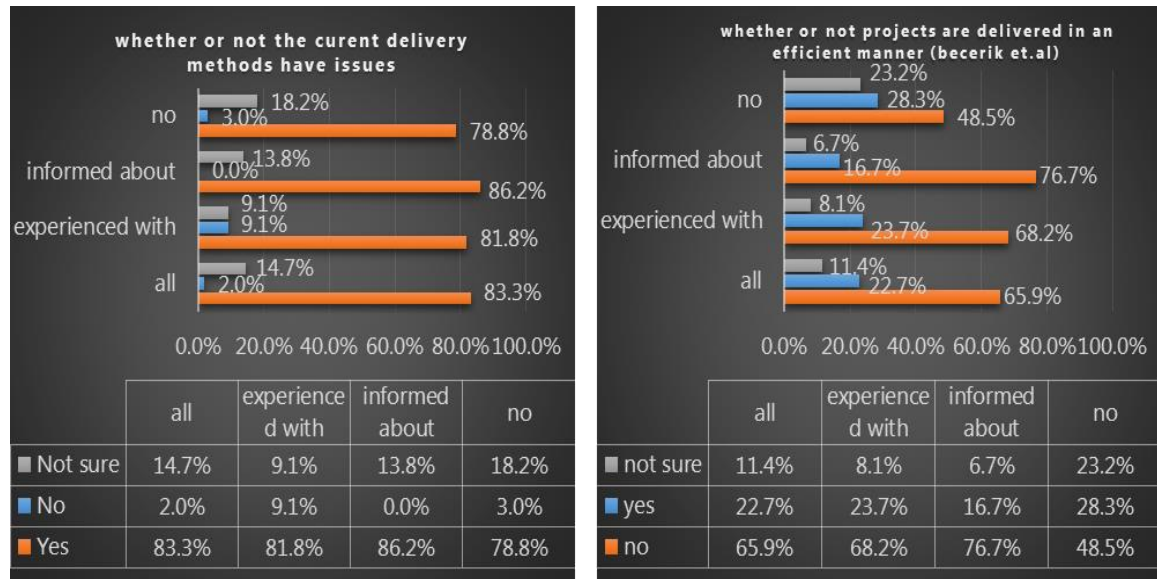
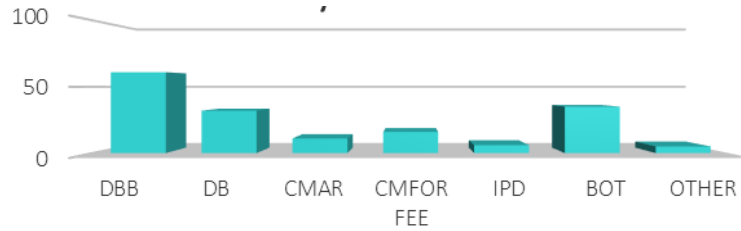


Figure 24. Issues with current delivery methods

As expected the respondents' previous delivery method experiences in design-bid-build and build-operate-transfer is more than other delivery systems. DBB counted 61 times and BOT 35 times (Figure 25).

Figure 25. Previous delivery method experiences



	DBB	DB	CMAR	CMFOR FEE	IPD	BOT	OTHER
Series1	61	32	11	16	6	35	5

The table of cross tabulation is generated by SPSS; the percentages in detail are given for role in the industry and previous experience or information about the IPD (Table 2) and (Figure 26)

Table 20. Role in industry - previous IPD experience

role in industry * informed or experienced with IPD Crosstabulation											
% within role in industry		role in industry									Total
		-oth-	Educa tor	Owne r	Archit ect	Facilities Manager	Engine er	Sub.	G.C.	Supplier / Manufacture r	
informed or experienced with IPD	Yes I'm experienc ed with IPD		7.1%	21%			8.3%	11.1%	5.0%	25.0%	11%
	Yes I'm informed about IPD		35.7%	57%	100%	100.0%	45.8%	66.7%	85.0%	25.0%	57%
	No	100%	57.1%	21%			45.8%	22.2%	10.0%	50.0%	32%
Total		100%	100%	100%	100%	100.0%	100.0%	100.0%	100%	100.0%	10...

**Role in Industry * informed or experienced with IPD Crosstabulation
% within role in industry**

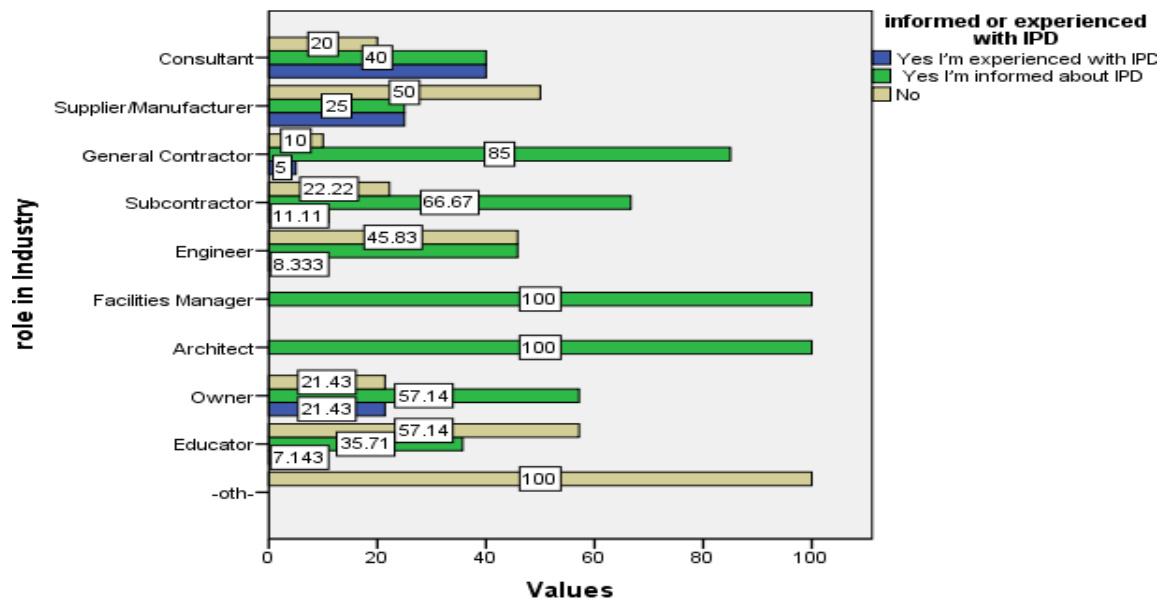


Figure 26. Role in industry - previous IPD experience

4.1.2 IPD related questions

The respondents asked about their previous IPD experience. Recorded data show that about 70% of the respondent individuals do not have IPD experience. (Figure 27)

A06 PREVIOUS IPD EXPERIENCE



Figure 27 IPD experience

By other questioning industry people who were engaged in industry sector have been questioned about their previous experience with the Integrated Project Delivery system.

Surprisingly the number experienced people exceeded %10 of participants with 11 out of 102. This finding is of great importance in our study as the option of experienced people carries more practical significance than of people who merely got informed about this delivery method. Having said that, it should not undermine the importance of informing people about this system

While the number of experienced participants had been supposed to be less than 5%, their number had exceeded more than 10%. Correspondingly, 11 of 102 was experienced with IPD. This question is critical to our study, because it identifies the experienced people and bold their opinion. Opinions of experienced people more important than the people who informed with IPD for the study. Remarkably, familiarity of industry members with IPD and its basic principles, resulted automatically their answers got weighted (Figure 28).

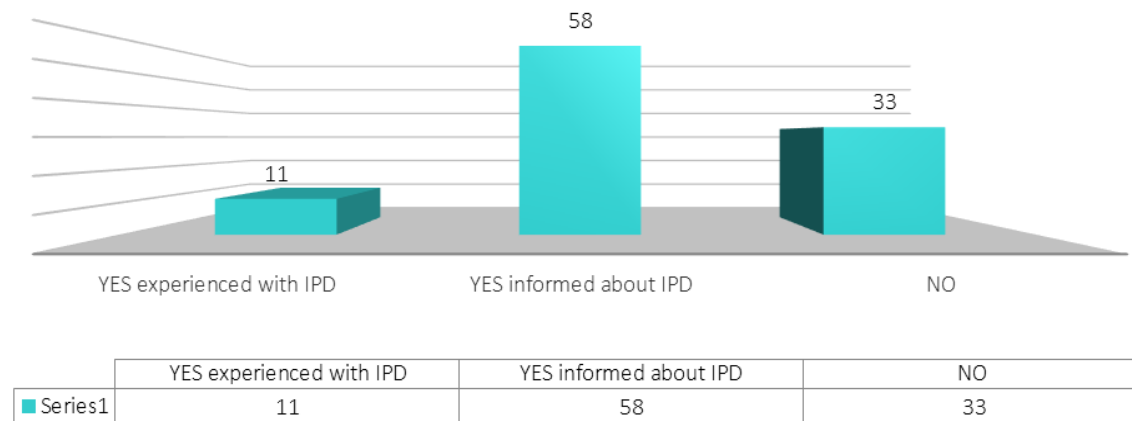


Figure 28. Experienced with or informed about IPD

The survey which had been conducted in American university of Lebanon by Rached et.al. (2014) manifest the result that willingness to IPD is high in the oil and gas sector in the coastal countries with 43% being sure for IPD implementation. Likely, in our study, eagerness to participate in IPD project is 94% (Figure 29).

Main causes for accepting or ignoring the IPD was explored and two reason related to our aim have been found. First one was “projects delivered in efficient manner” and the

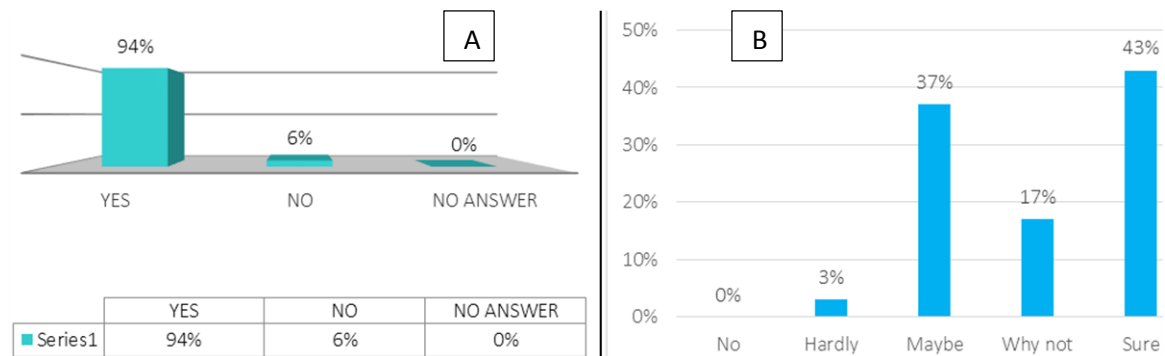


Figure 29. Eagerness and willingness to use IPD (this study's findings-left) (Rached et al. 2014 – Right)

Second one was “IPD avoids adversarial relations between project participants”. These two reasons for accepting IPD were on top of the acceptance list. However, two main causes for ignoring IPD were “it doesn’t work with my business model” and “because the risks of adopting a new delivery system are too high” (Figure 31).

The consensus vote of respondents went through “yes, because projects are delivered more efficiently”. 51 of 102 (50%) choose the first choice. This part contains two comparisons, first with Rached et.al and second with Becerik et.al 2010 study. For first comparison results reveal that 43% of respondents agree that adversarial relationships impressed projects outcomes (Figure 30). For the second comparison, almost 60.60% of experienced workers choose the first choice (Figure 32). But, 72.7% of respondents choose the same choice in our study. Experienced people, mostly has a negative approach to IPD. They mostly choose “no it doesn’t work with my work model”. As a result, they are interested

to participate in IPD project, but firstly they should change their work model (Figure 32). The counts and percentages shown in detail in the table next to its figure (Table 21).

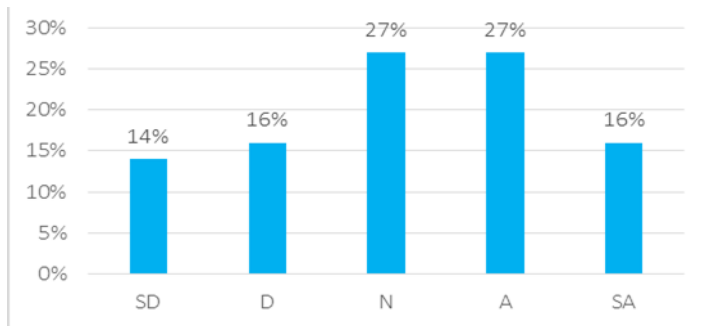


Figure 30. Adversarial relationship between the different parties (Rached et.al 2014)

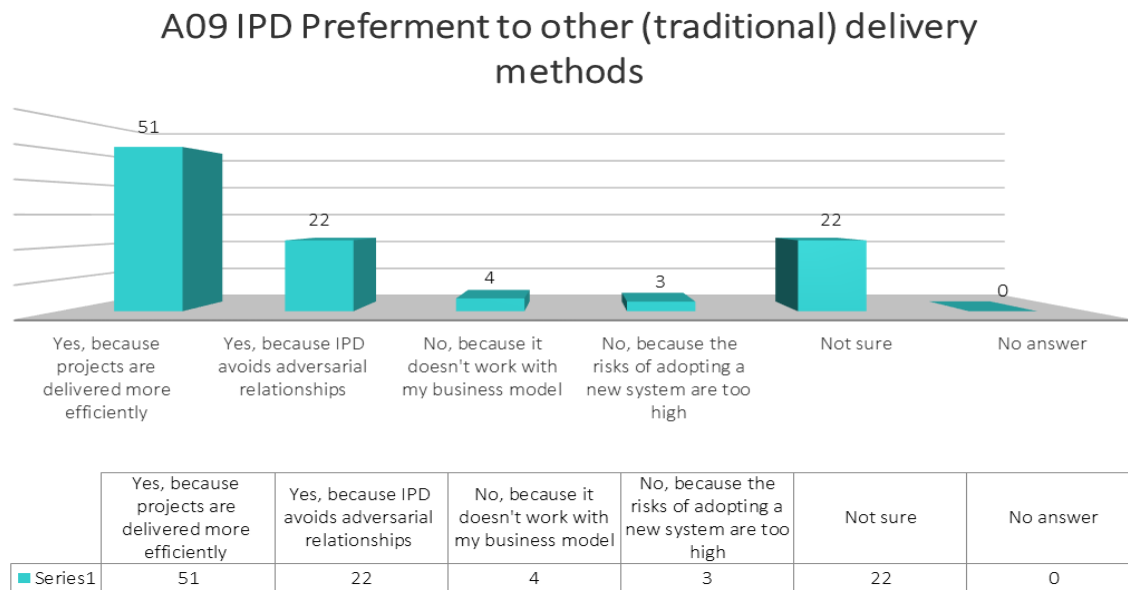


Figure 31. IPD preferment to traditional delivery methods

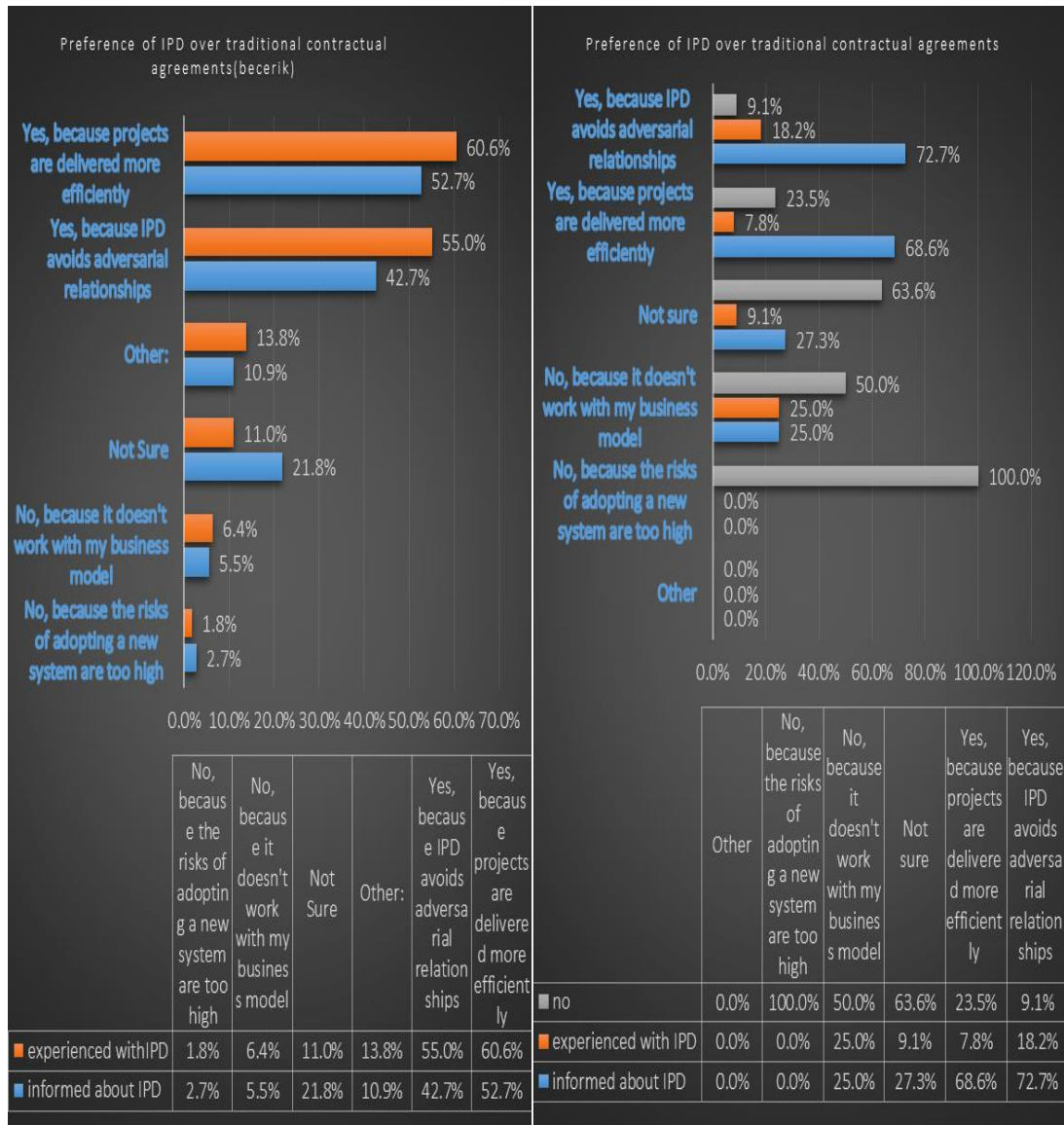


Figure 32. Comparison of IPD preferment to traditional delivery methods with previous studies

Table 21. In detail table for IPD preferment to traditional delivery methods

Preference of IPD over traditional contractual agreements ^ informed or experienced with IPD Crosstabulation						
			informed or experienced with IPD			Total
			Yes I'm experienced with IPD	Yes I'm informed about IPD	No	
Preference of IPD over traditional contractual agreements	Yes, because projects are delivered more efficiently	Count	4	35	12	51
		Expected Count	5.5	29.0	16.5	51.0
		% within Preference of IPD over traditional contractual agreements	7.8%	68.6%	23.5%	100%
	Yes, because IPD avoids adversarial relationships	Count	4	16	2	22
		Expected Count	2.4	12.5	7.1	22.0
		% within Preference of IPD over traditional contractual agreements	18.2%	72.7%	9.1%	100%
	No, because it doesn't work with my business model	Count	1	1	2	4
		Expected Count	.4	2.3	1.3	4.0
		% within Preference of IPD over traditional contractual agreements	25.0%	25.0%	50.0%	100%
	No, because the risks of adopting a new system are too high	Count	0	0	3	3
		Expected Count	.3	1.7	1.0	3.0
		% within Preference of IPD over traditional contractual agreements	0.0%	0.0%	100.0%	100%
	Not sure	Count	2	6	14	22
		Expected Count	2.4	12.5	7.1	22.0
		% within Preference of IPD over traditional contractual agreements	9.1%	27.3%	63.6%	100%
	Total	Count	11	58	33	102
		Expected Count	11.0	58.0	33.0	102.0
		% within Preference of IPD over traditional contractual agreements	10.8%	56.9%	32.4%	100%

A10 is the ranking question. Designed in order to obtain more precise answers. By the way respondents enabled to choose their answers in descending order of importance. Employed survey motor, Lime survey, export them in ten ranking groups. With the help of “3-D 100% stacked column” charts in MS Excel, these ten charts are unified and illustrated beside each other in one table. In the Figure 30, for instance, 26% of respondents has ranked the ‘collaborative team spirit’ option as the most important one. If the same logic be

generalized for all ranking types and success factors, the success factor will be listed as below:

1. Collaborative team spirit 26% - willingness to change 23%
2. Collaborative team spirit 29%
3. Well defined contractual relationships 24%

This list highlights the fact that collaborative team spirit is very important for conducting an IPD project.

As it mentioned in the previous chapter the best and most appropriate delivery method which can be applied to IPD is the CMAR method. In contrast to a previous statement, our survey revealed different results. That is, the majority of individuals in our research considered that DB is the most appropriate one (Figure 34).

The most of the experienced people conceded that IPD could be applied to none of the delivery methods, but it should be a separate contract at the onset of the project. On the other hand, majority of informed people believes that integrated project delivery has a reasonable synchronization with the DB. (Figure 35 and Figure 36).

Comparing our findings with previous studies in the United States reveals that the highest rank and the second highest rank methods chosen by experienced people are DB and CMAR, respectively. It means they believe that integrated project delivery could have the best cooperation with Design-Build (11.8% in the Middle East and 85.3% for the United States) in the first row and then with Construction Management at Risk delivery methods in the second row (Figure 35).

As notified previously, IPD is based on mutual respect, mutual trust and mutual reward. Therefore, this is the basic prerequisite for applying IPD. There seems to be a tendency towards IPD, but the trust related issues should be solved first (Figure 34). The premier concern of industry participants is “do not trust other industry professional enough to work with them as a team on a project”; so that the main stream and trend should be changed.

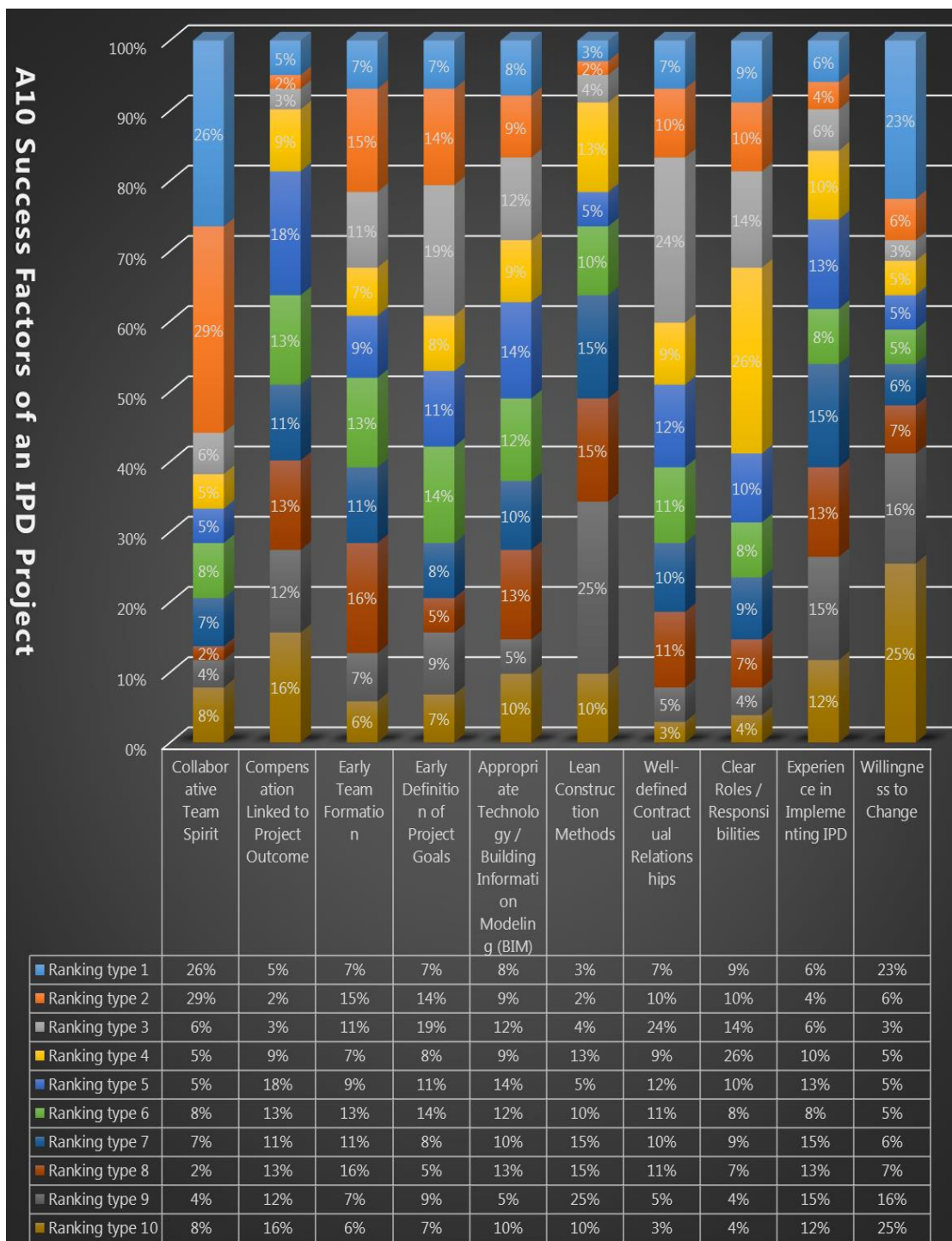


Figure 33. IPD success factors

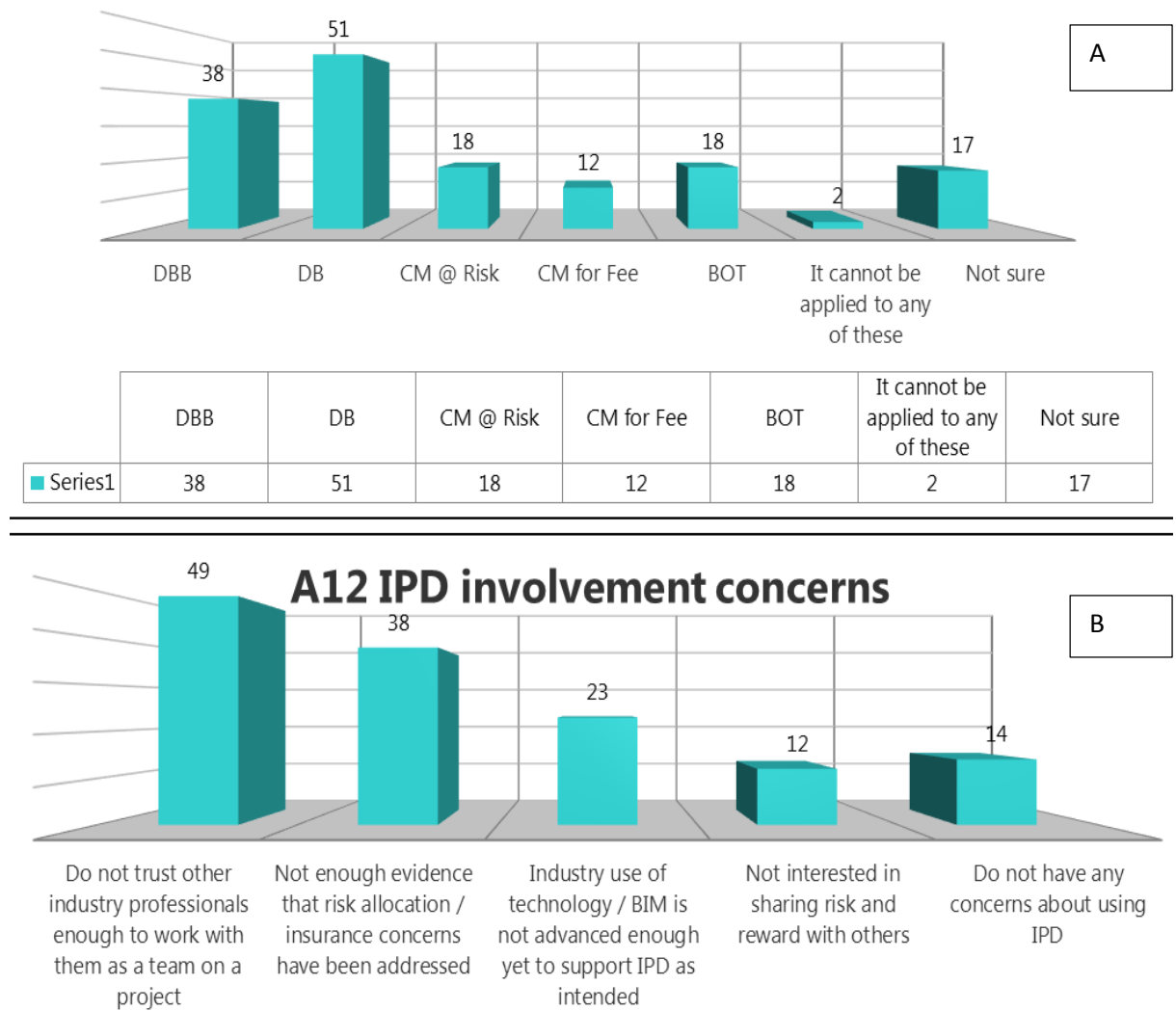


Figure 34. Best delivery methods for IPD (A) - IPD involvement concerns (B)

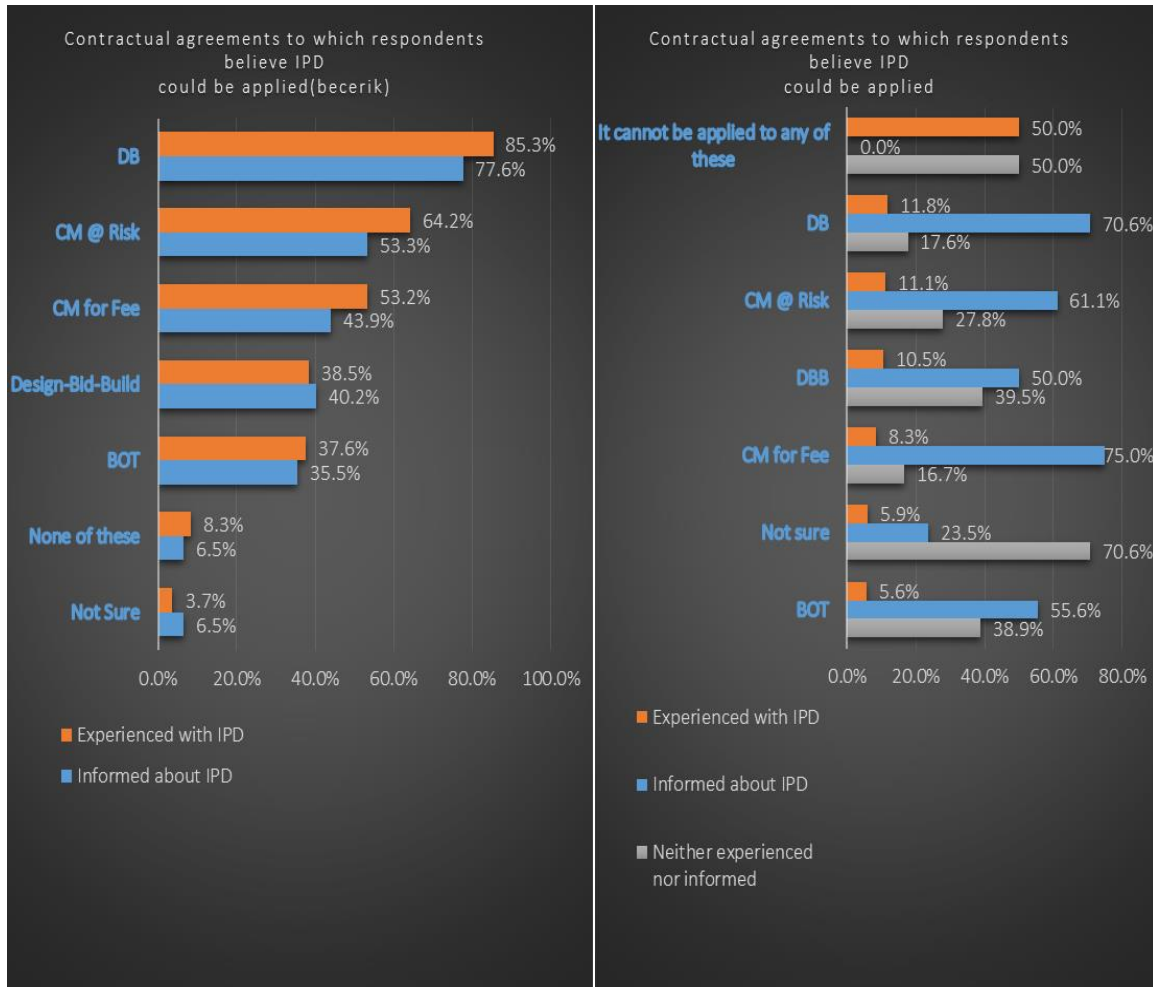


Figure 35. Best delivery method for IPD (vs. previous studies)

Crosstab

			informed or experienced with IPD			Total
			Yes I'm experienced with IPD	Yes I'm informed about IPD	No	
applicableDB	0	Count	5	22	24	51
		Expected Count	5.5	29.0	16.5	51.0
		% within applicableDB	9.8%	43.1%	47.1%	100.0%
	1	Count	6	36	9	51
		Expected Count	5.5	29.0	16.5	51.0
		% within applicableDB	11.8%	70.6%	17.6%	100.0%
Total	Count		11	58	33	102
	Expected Count		11.0	58.0	33.0	102.0
	% within applicableDB		10.8%	56.9%	32.4%	100.0%

Crosstab

			informed or experienced with IPD			Total
			Yes I'm experienced with IPD	Yes I'm informed about IPD	No	
cantbeapplied	0	Count	10	58	32	100
		Expected Count	10.8	56.9	32.4	100.0
		% within cantbeapplied	10.0%	58.0%	32.0%	100.0%
	1	Count	1	0	1	2
		Expected Count	.2	1.1	.6	2.0
		% within cantbeapplied	50.0%	0.0%	50.0%	100.0%
Total	Count		11	58	33	102
	Expected Count		11.0	58.0	33.0	102.0
	% within cantbeapplied		10.8%	56.9%	32.4%	100.0%

Crosstab

			informed or experienced with IPD			Total
			Yes I'm experienced with IPD	Yes I'm informed about IPD	No	
applicableCM@R	0	Count	9	47	28	84
		Expected Count	9.1	47.8	27.2	84.0
		% within applicableCM@R	10.7%	56.0%	33.3%	100.0%
	1	Count	2	11	5	18
		Expected Count	1.9	10.2	5.8	18.0
		% within applicableCM@R	11.1%	61.1%	27.8%	100.0%
Total	Count		11	58	33	102
	Expected Count		11.0	58.0	33.0	102.0
	% within applicableCM@R		10.8%	56.9%	32.4%	100.0%

Figure 36. Best delivery method for IPD for DB- CM@R and N/A according to respondents

4.1.3 BIM related questions – information technology

In this section; industry members, professionals and experts have been examined about their knowledge and experience about information technology advances and its applicable mode to IPD as Building Information Modeling. About one third of our examined society experienced about BIM and the other one third was informed about BIM. Then the informed and experienced people asked about the capabilities of Building Information Modeling, visualization of form was the top hit capability. After that the construction simulation was the second top hit capability. As expected the virtual reality is the most popular aspect of BIM (Figure 37).

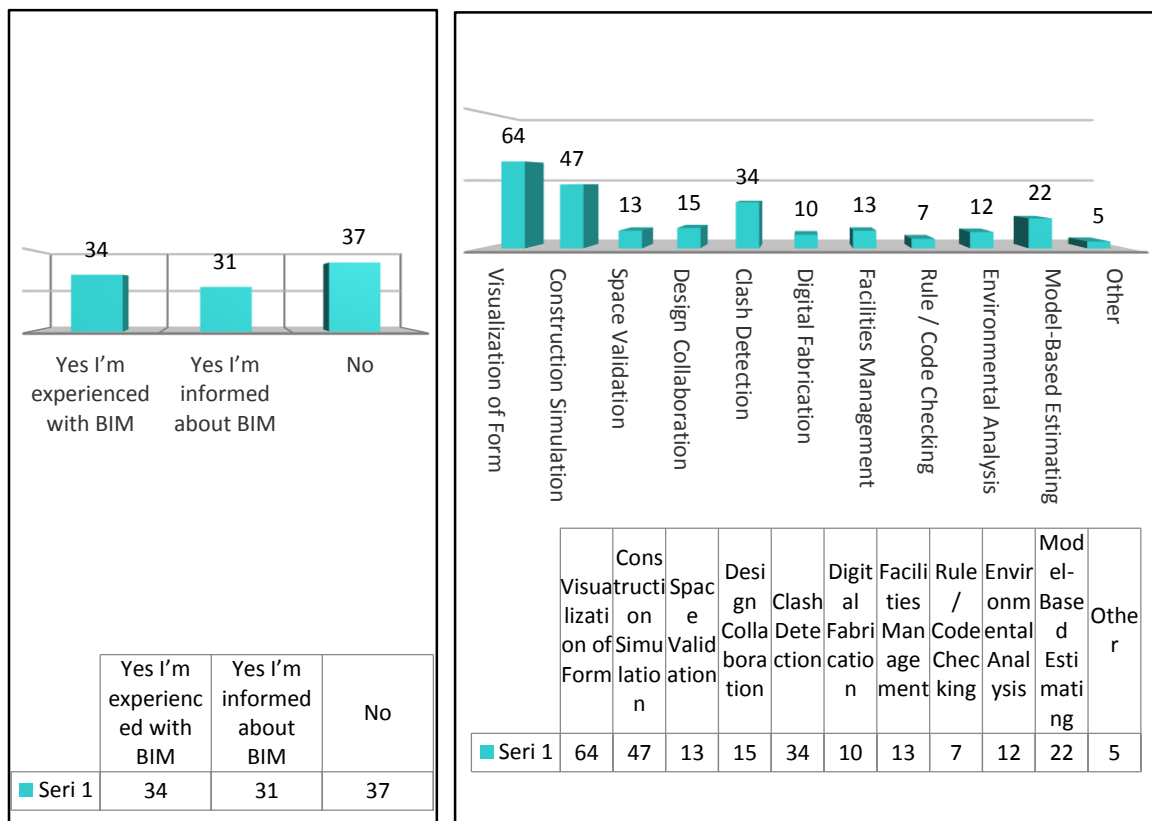


Figure 37. BIM awareness (left) and BIM capabilities (Right)

Experienced group chooses clash detection, digital fabrication, construction simulation as descending list, while the informed group preferred environmental analysis of BIM in first row by 50%. Rule and code checking had been chosen by industry members who didn't have any experience and knowledge of BIM.

While in Kent-Becerik's study Visualization of Form and Clash Detection gain priority to other capabilities by experienced and informed industry members, in our study, clash detection was coming to the first row of experienced people. Simultaneously, digital fabrication follows the clash detection. The number of people who choose clash detection, digital fabrication and construction simulation provided in detail (Figure 38) and (Table 22).

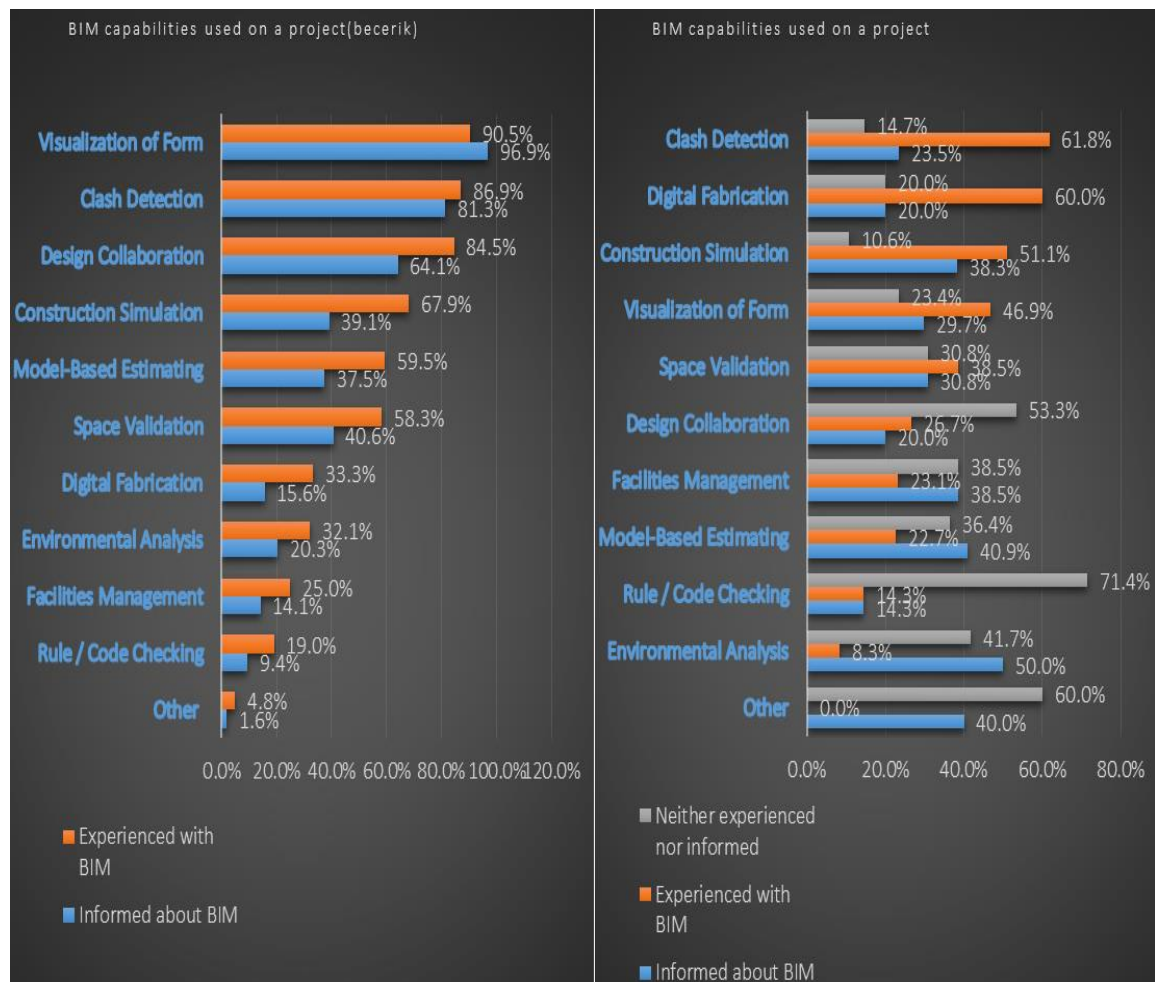


Figure 38. BIM capabilities

Table 22. Preferment of informed and experienced people with BIM and its capabilities

Crosstab

			informed or experienced with BIM			Total
			Yes I'm experienced with BIM	Yes I'm informed about BIM	No	
Clash Detection	0	Count	13	23	32	68
		Expected Count	22.7	20.7	24.7	68.0
		% within Clash Detection	19.1%	33.8%	47.1%	100.0%
	1	Count	21	8	5	34
		Expected Count	11.3	10.3	12.3	34.0
		% within Clash Detection	61.8%	23.5%	14.7%	100.0%
Total	Count	34	31	37	102	
	Expected Count	34.0	31.0	37.0	102.0	
	% within Clash Detection	33.3%	30.4%	36.3%	100.0%	

Crosstab

			informed or experienced with BIM			Total
			Yes I'm experienced with BIM	Yes I'm informed about BIM	No	
Digital Fabrication	0	Count	28	29	35	92
		Expected Count	30.7	28.0	33.4	92.0
		% within Digital Fabrication	30.4%	31.5%	38.0%	100.0%
	1	Count	6	2	2	10
		Expected Count	3.3	3.0	3.6	10.0
		% within Digital Fabrication	60.0%	20.0%	20.0%	100.0%
Total		Count	34	31	37	102
		Expected Count	34.0	31.0	37.0	102.0
		% within Digital Fabrication	33.3%	30.4%	36.3%	100.0%

Crosstab

			informed or experienced with BIM			Total
			Yes I'm experienced with BIM	Yes I'm informed about BIM	No	
Construction Simulation	0	Count	10	13	32	55
		Expected Count	18.3	16.7	20.0	55.0
		% within Construction Simulation	18.2%	23.6%	58.2%	100.0%
	1	Count	24	18	5	47
		Expected Count	15.7	14.3	17.0	47.0
		% within Construction Simulation	51.1%	38.3%	10.6%	100.0%
Total	Count	34	31	37	102	
	Expected Count	34.0	31.0	37.0	102.0	
	% within Construction Simulation	33.3%	30.4%	36.3%	100.0%	

Also professionals and experts asked whether BIM is prerequisite for IPD or not? Responses reveal that BIM is absolutely a prerequisite for IPD. With the numbers of 65 from 102 (Figure 39- Right). But still an absence of BIM experts and professionals are sensible. Because almost half of respondents claim that their company is not well-trained enough (Figure 39 - left). As stated in the table below, also, 6 (54.4%) of people who experienced with IPD, experienced with BIM as well (Table 22). This table which generated by IBM SPSS 23 reveals the vital role of BIM for IPD.

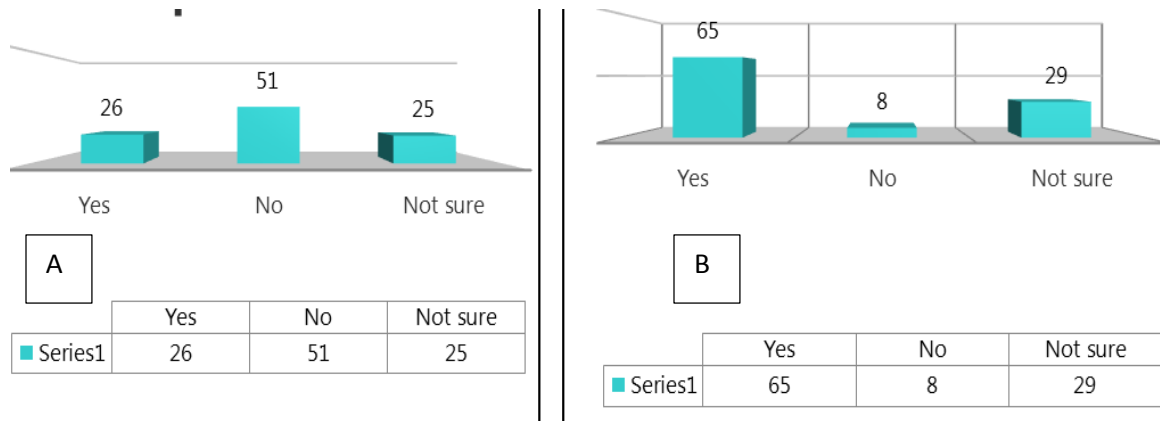


Figure 39. If companies well-trained for BIM (A), does BIM prerequisite for IPD (B)

Table 23. Informed and experienced with BIM and IPD

informed or experienced with IPD * informed or experienced with BIM Crosstabulation						
			informed or experienced with BIM			Total
			Yes I'm experienced with BIM	Yes I'm informed about BIM	No	
informed or experienced with IPD	Yes I'm experienced with IPD	Count	6	2	3	11
		Expected Count	3.7	3.3	4.0	11.0
		% within informed or experienced with IPD	54.5%	18.2%	27%	100%
	Yes I'm informed about IPD	Count	25	21	12	58
		Expected Count	19.3	17.6	21.0	58.0
		% within informed or experienced with IPD	43.1%	36.2%	21%	100%
	No	Count	3	8	22	33
		Expected Count	11.0	10.0	12.0	33.0
		% within informed or experienced with IPD	9.1%	24.2%	67%	100%
Total		Count	34	31	37	102
		Expected Count	34.0	31.0	37.0	102.0
		% within informed or experienced with IPD	33.3%	30.4%	36%	100%

The bar charts compare the answers of experienced and informed experts in terms of whether BIM is prerequisite for IPD or not. It is clear that the proportion of experts who experienced with IPD and choose 'No' is far higher from 'Yes' answers in Becerik et al.'s report. Contrariwise, both of experienced and informed test takers overwhelmingly agree that BIM is prerequisite for IPD in our study (Figure 40). The count and the percentage of results given in detail in the table below which shows the mainstream of professionals' idea with "BIM is prerequisite for IPD" (Table 22). In upcoming sessions the correlation of BIM and IPD will be discussed more.

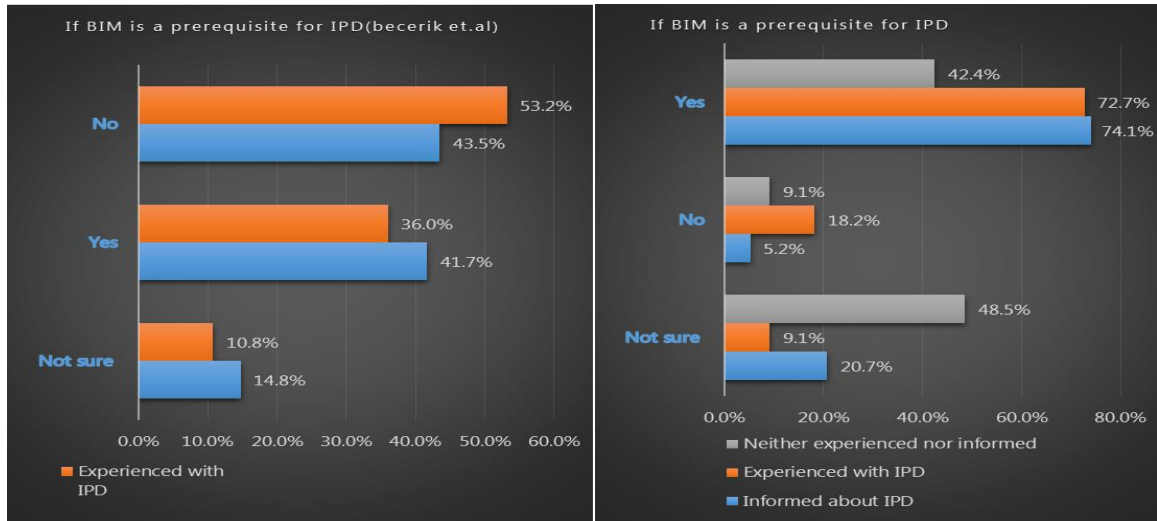


Figure 40. If BIM is a prerequisite for IPD

Table 24. If BIM is a prerequisite for IPD

informed or experienced with IPD ^ If BIM is a prerequisite for IPD Crosstabulation						
			If BIM is a prerequisite for IPD			Total
			Yes	No	Not sure	
informed or experienced with IPD	Yes I'm experienced with IPD	Count	8	2	1	11
		Expected Count	7.0	.9	3.1	11.0
		% within informed or experienced with IPD	73%	18%	9.1%	100...
	Yes I'm informed about IPD	Count	43	3	12	58
		Expected Count	37.0	4.5	16.5	58.0
		% within informed or experienced with IPD	74%	5.2%	21%	100...
	No	Count	14	3	16	33
		Expected Count	21.0	2.6	9.4	33.0
		% within informed or experienced with IPD	42%	9.1%	48%	100...
Total		Count	65	8	29	102
		Expected Count	65.0	8.0	29.0	102
		% within informed or experienced with IPD	64%	7.8%	28%	100...

4.1.4 Acceptance issues

In this part the issues and acceptance obstacles of IPD will be scanned and examined. The factors placed here is generally extracted from previous studies and experts' opinions about IPD. Firstly they have been asked whether IPD one day widely embraced in Turkey and the Middle East or not. The overwhelming consensus vote was for 'yes' choice. 69 of 102 agree that IPD is the future of project delivery in the Middle East. This shows the optimistic attitude of industry members toward IPD once again (Figure 41). On the other hand, IPD

subjects to a series of problems and obstacles which should be improved prior to its implementation. The main problem is “lack of IPD awareness “and the next one is “fear of change”. By the way, this study and all other similar studies like this, playing a substantial role in familiarize IPD and its main principles. Academically education (capstone courses) and advertisements will be beneficial for the issues as well as a governmental attempt for structuring well-suited legal framework (Figure 42).

IPD ranked as the most easy collaborative manner for parties which followed by DB (Figure 43). Also, previous studies confirm that collaboration between different parties are districted because 60 percent of respondents disagree with enough collaboration between different parties (Figure 44)

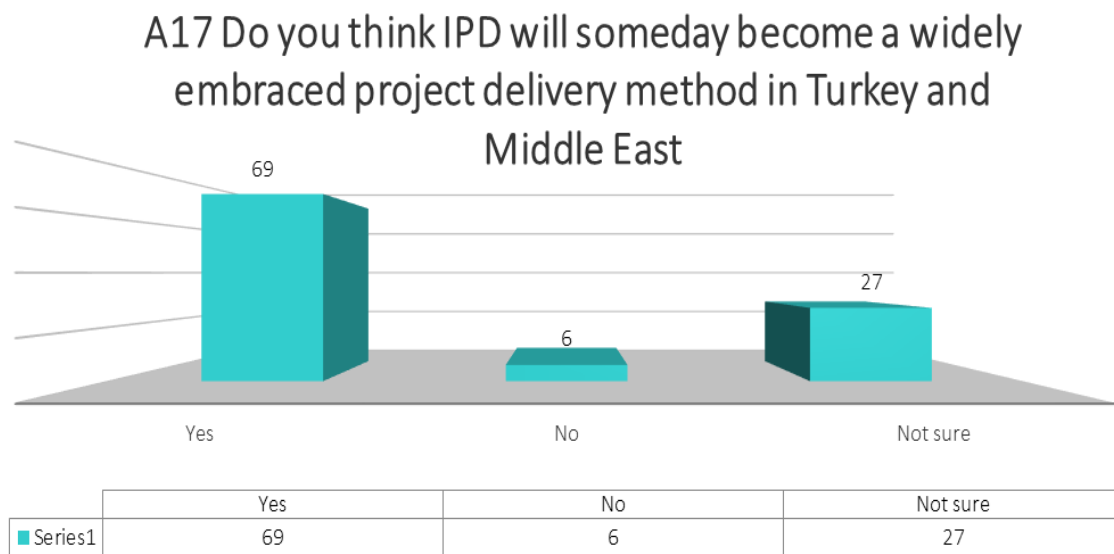


Figure 41. Future of IPD in Middle East

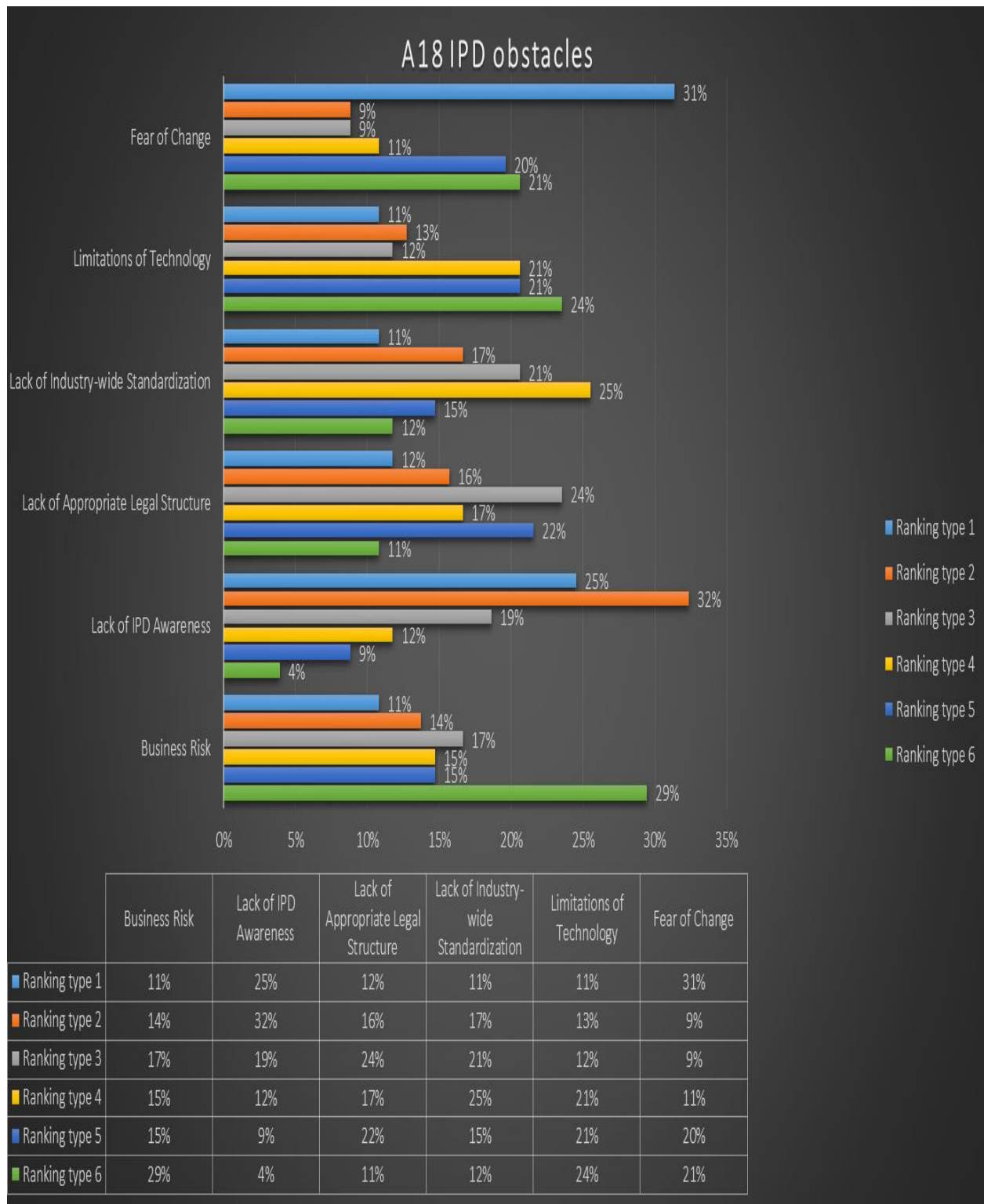


Figure 42. Obstacles for IPD

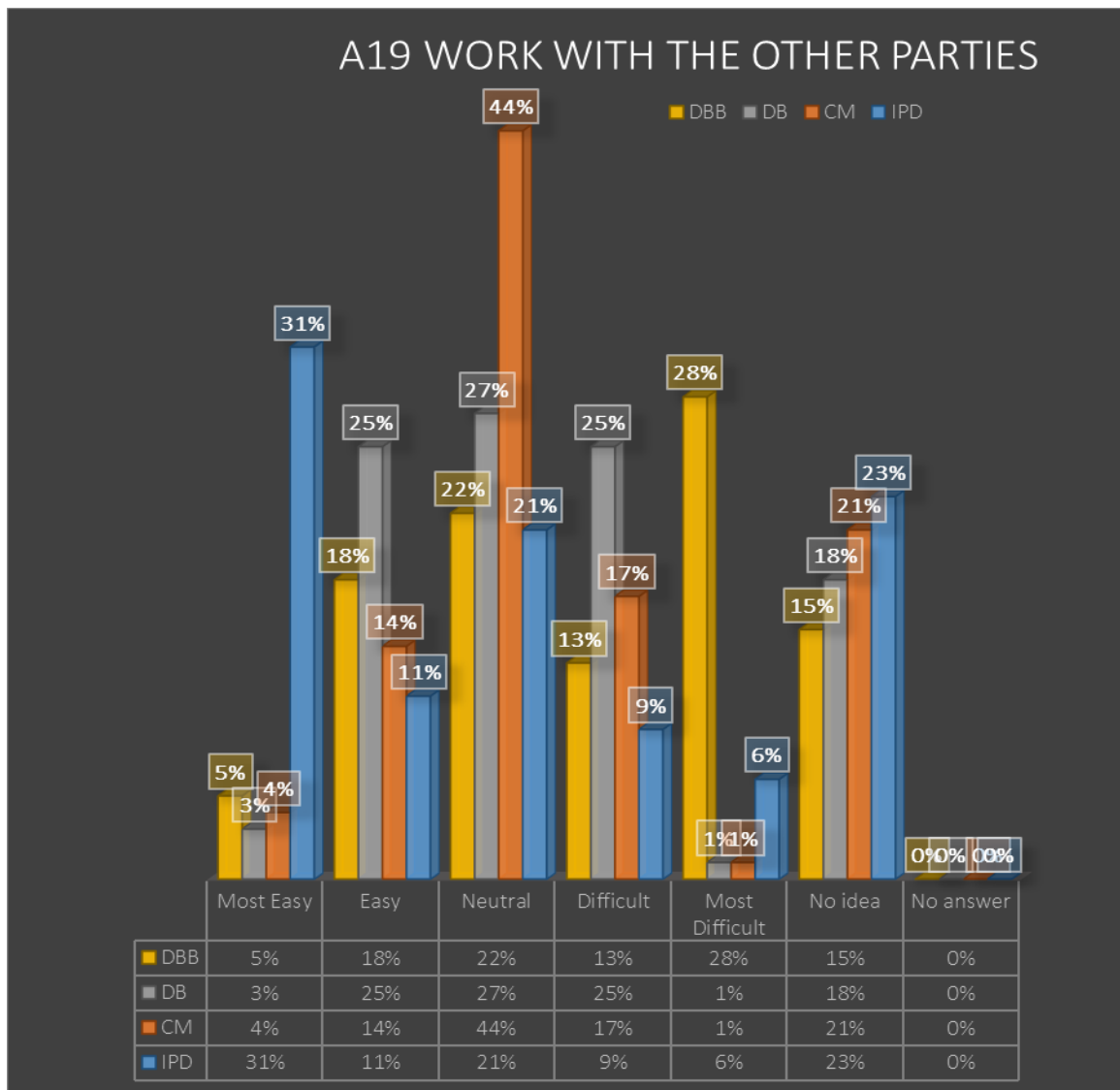


Figure 43. Collaboration between parties in different delivery systems

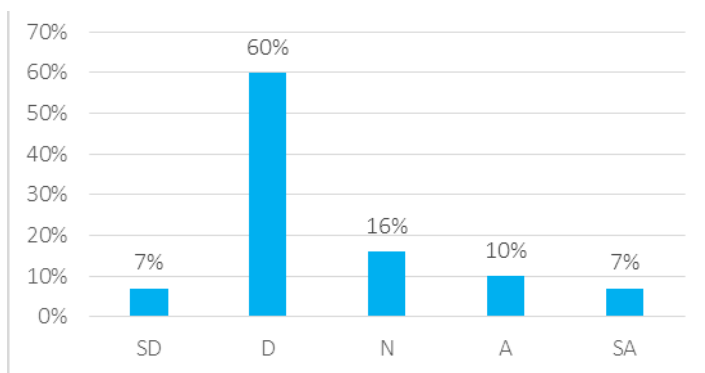


Figure 44. Collaboration between the different parties according to Rached et.al.

4.1.5 Industry trends

In this part of the research respondents questioned about their experienced project performance metrics. In order to measure project performance the best metric was cost, according to both experienced and informed experts and professionals. While, people who choose the other choice, suggested alternatives like ‘the combination of cost, schedule and quality’ to obtain more realistic results (Figure 45).

Afterwards, they have been questioned about involvement of different parties in different stages of the project. As it is obvious, generally, believes that the general contractor and subcontractor don’t participate in design and pre design phase (Figure 46). Statistics from previous studies, additionally, represent the similar outcomes. Examined people in oil and gas construction industry in coastal countries disagree with early involvement of key role players (especially general contractor and subcontractors) in traditional delivery method (Figure 47)

Both experienced and informed people agree that IPD has cohesive cooperation with all types of projects (Figure 48)

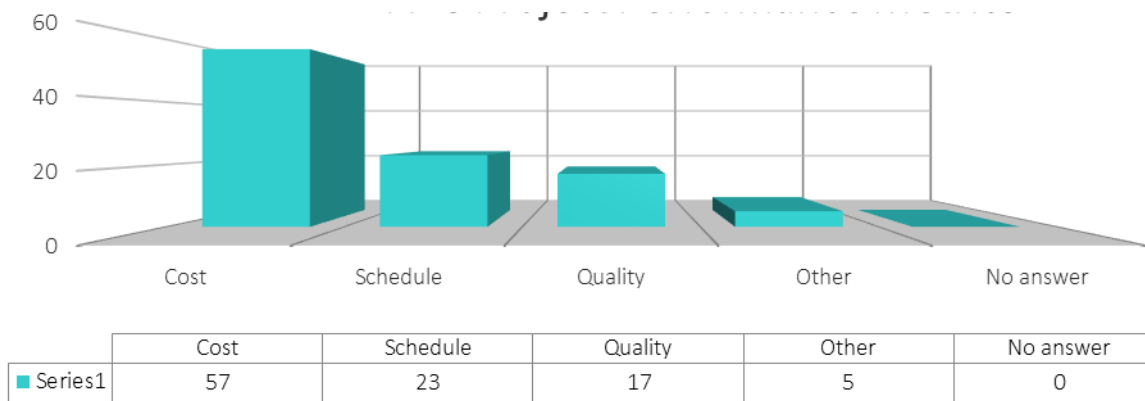


Figure 45. Project performance measurement metrics

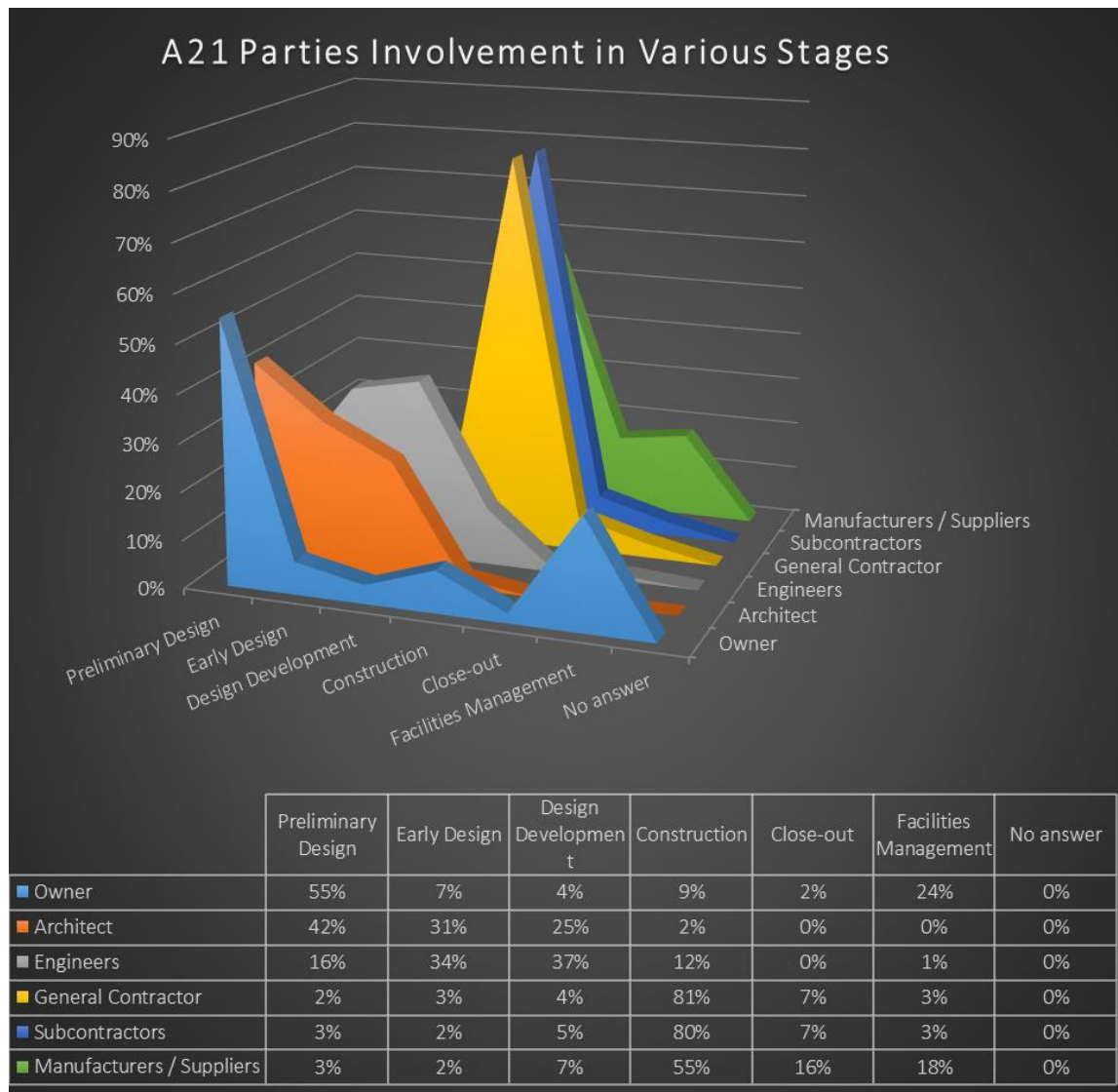


Figure 46. Involvement of key participant

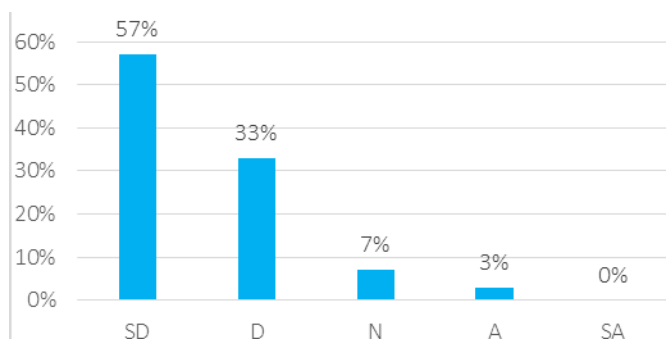


Figure 47. Involvement of contractor and subcontractor in pre-design and design phase (Rached et.al 2014)

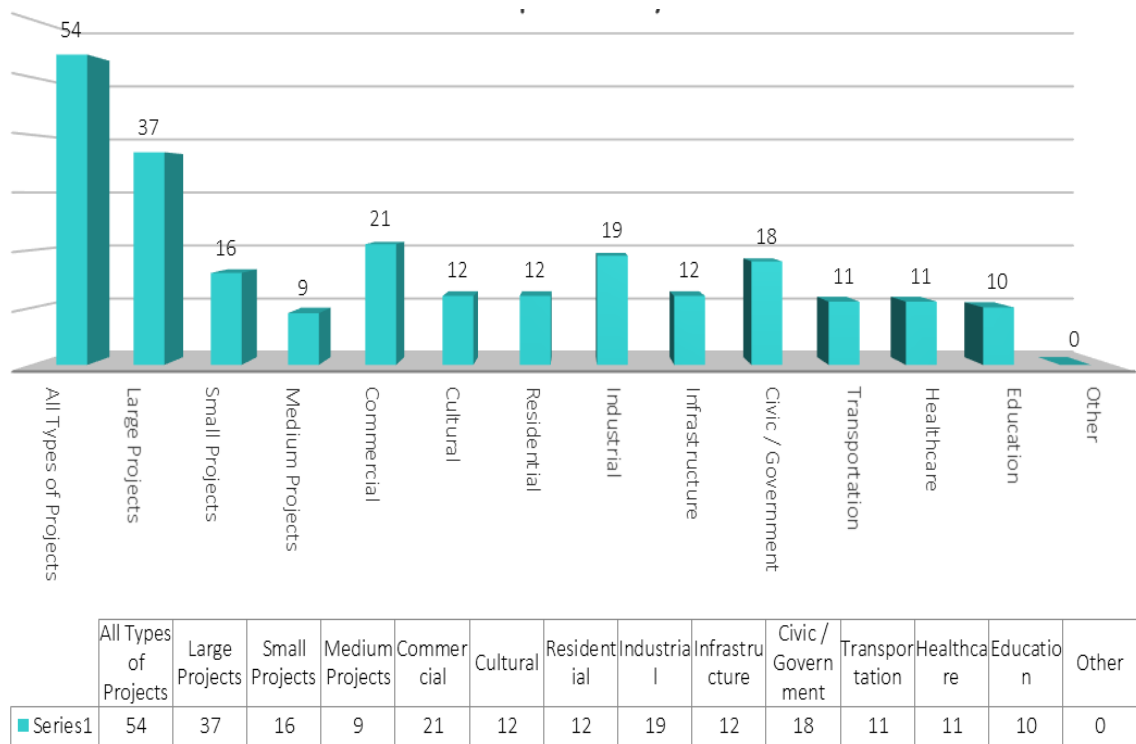


Figure 48. Which type of the project does it best for

4.1.6 Overall assessment

As discussed previously, there is the positive attitude of industry members toward IPD. People are absolutely optimistic about IPD. Overall, to quantify their attitude, two question have been designed at the last stage of our study. First, they think that in the upcoming 5 to 10 year IPD will gain popularity as delivery method in the region (Figure 49). IPD, also, will gain 5% to 10% of market share (Figure 50)

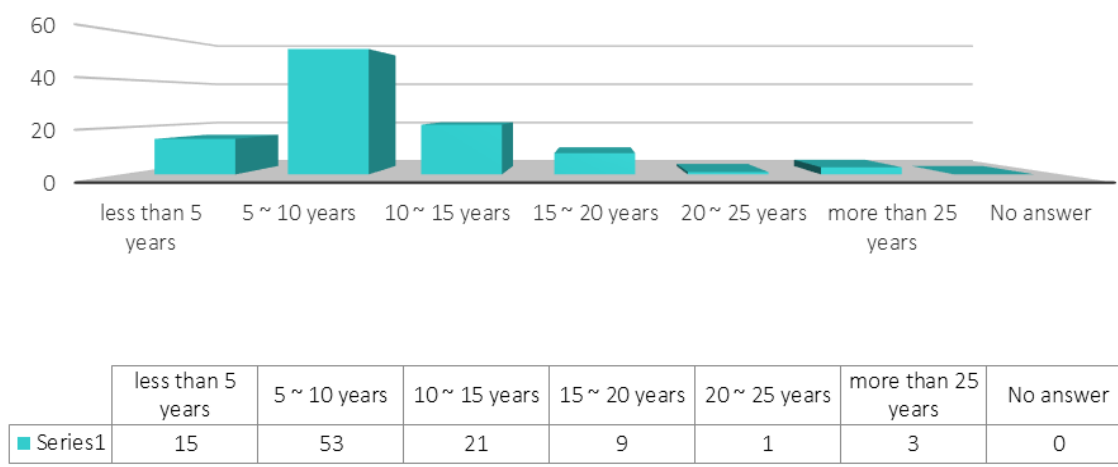


Figure 49. Configuration of IPD

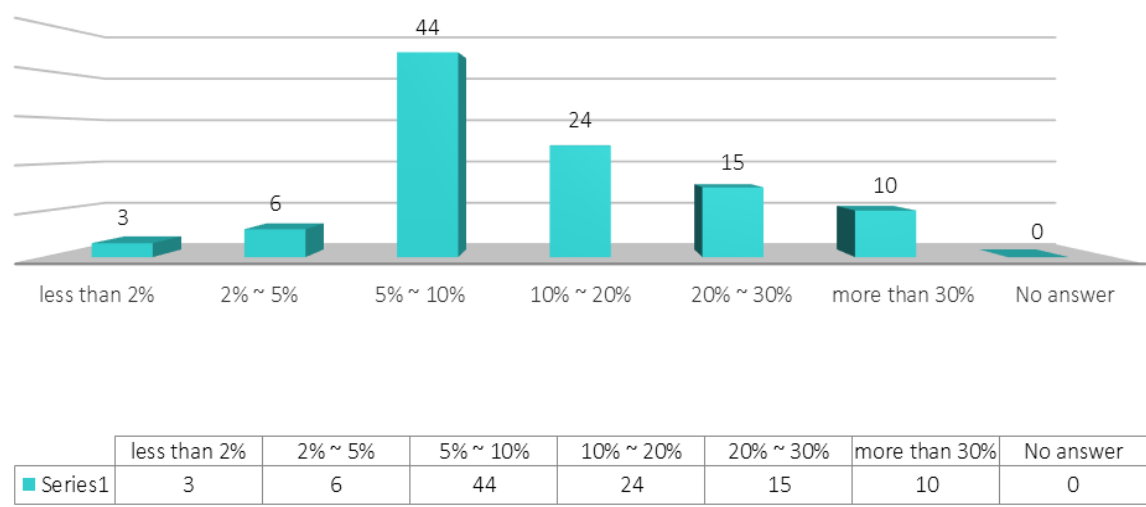


Figure 50. Market share

CHAPTER 5

CONCLUSION

Nowadays, the phrase “I am not rich enough to buy cheap things” is a paradigm between consumers from every category. In AEC industry, like all other categories, the main logic is turned back to the pure meaning of this phrase. If we want to generalize the meaning of this phrase in AEC industry, it will be realized here that construction industry wants to experience a change from Design-Bid-Build system to more collaborating environment like IPD. For conducting the project, claims are about no values, but the accomplishment of the project timing, budgeting and the quality is the core values. Many of participants and members are on the same wavelength that short-term solution is not the key; contrariwise, the long-term, long-lasting and sustainable solutions are worthy.

5.1 Main findings

The main inferences from this study could be listed as below:

1. A direct correlation between experience and eagerness to implementation of IPD in Turkey and Middle Eastern countries was observed.
2. The most important principles of IPD and BIM were listed based on the principals which are the most popular ones. The citation list had been generated to both lists of principles. IPD and BIM have a strong correlation in terms of their most cited principles.

3. IPD was compared to three main delivery methods (DBB, DB and CM@R) and their pros and cons were tabulated. The result obtained reveals that there is not a single comprehensive delivery method for all types of projects. Contrariwise, the most efficient delivery system should be tailored to each unique project by contributions of construction manager or construction management firm.
4. People who have experience with IPD prefer to participate in IPD projects more than those who are not experienced.
5. Eagerness and willingness to participate in IPD is absolutely high the region.
6. Individuals from different points of the world, especially from Unites States and Mediterranean countries, prefer IPD to any other traditional delivery methods. Nevertheless, in this study for Turkey and Middle Eastern countries, experienced people claims that their work model is not adjustable for IPD. Therefore, fundamental changes should be applied. The opposite cross-point view, informed respondents, totally accept the IPD because of its efficiency.
7. As it was supported in literature, the best and the most suitable delivery method for IPD is DB
8. About the comparison of BIM in terms of its functionalities, while US people ranked clash detection as the most important functionality of BIM, Turkish and the Middle Eastern participant ranked visualization of form and construction simulation as the most important capability of BIM for the industry.
9. Although industry members of the United States construction sector thought that BIM is not the prerequisite for IPD, participants from Turkey and Middle East believe that BIM is the main prerequisite of IPD.
10. IPD is the future of project delivery method for Turkey and the Middle East, according to both previous studies in literature and industry members' optimistic attitude toward this delivery method. .
11. According to responses of test takers it has been inferred that the best metric for project performance measure is cost. However, responses of this study and previous studies consensually reveals that by a logical combination of cost, schedule and quality, the obtained results will be more realistic. It means that the triple-dimensional algorithm of cost, schedule, and quality will analyze the process more

true than single dimensional. Also people think that IPD could have cohesive cooperate with all types of projects with any scale.

12. IPD certainly the best project delivery system which has been generated so far in terms of supporting the general contractor and subcontractors. IPD, also, enables contractors to participate in the early design and preliminary design phase unlike all other traditional methods. This property of IPD is resulted to more executable and user-friendly designs.
13. Despite the fact that individuals believe that in the upcoming 5 to 10 years IPD will gain almost 5% to 10% of the construction market share in Turkey and the Middle East, American respondents believe that it will cover about 20% of market in next 6 to 10 years. This is reasonable as our regions are relatively slower in adapting to new methods and technologies in the industry.
14. Chi-square test results by 0.813 clarifies a strong correlation between years of experience and willingness to participate in IPD projects. Therefore, this correlation endorses how they were suffering from traditional project delivery methods.
15. Pearson chi-square and t-test numerical analysis results, also, found out that 54% of IPD experienced people are experienced with BIM as well. Correspondingly, BIM could be considered as a prerequisite for IPD.

5.2 Limitations of the study

The main limitations of this document could be:

1. Various survey services (such as Google sheets, survey monkey, lime survey etc.) was available for this study. Then, many of analysis tools (SPSS, R, MS EXCEL, etc.) was available for the obtained results. Therefore, the true combination of correct survey service and appropriate analysis tool is vital. Also, the number of correlation coefficients (Chi Square Test, T-Test, Z-Test, Phi, Pearson, etc.) are relatively high. So that, the researcher should has adequate knowledge of descriptive statistics. Otherwise, achieved analysis from statistics experts may does not truly reflect surveyed experts' ideas.
2. The survey was conducted in wide geographical region. A number of experts was not accessible. Although each of respondents contributed to our survey was reliable

industry members (planning engineers, consultants, etc.), if we have a chance to connect and contact with other experts in different points of area, the research would have been more realistic values.

3. The respondents' opinions, sometimes, are definitely on opposite points of each other. Since the subject was controversial, good comment on obtained results was inevitable.
4. Cost limitations. The Lack of funding organizations for research purposes. For example sufficient funding can assist the researcher to travel and meet the key respondents face to face. Therefore, it enhances the quality of the research.
5. Fifth limitation was our research subject. Integrated project management is a relatively new system in construction management studies. The number of previously published documents is extremely limited. Additionally, the number of experienced or informed industry members are absolutely limited. This issue unable the researcher to go to in details about IPD.
6. The whole number of respondents is about 4% of whole (clicks on survey links on social media do not count). And lack of cooperation of human resource departments of organizations in distributing the electronic questionnaire among the employees.
7. Time limitations, the procrastinations of link receivers have exceeded the due date.
8. Ethics Committee of METU term and conditions. For example, the personal information question was optional, therefore, the respondents dismiss their own information part in the last session of the questionnaire. It means that the researcher couldn't access to their curriculum vitae in order to assign weight to their responses.
9. Bureaucracy was time consuming.

5.3 Recommendations for the future works

The major studies which could be solicited from this research for future works could be listed as below:

- IPD is the future of project delivery systems in Turkey and Middle East but still limitations and shortcomings prevent the wide application of it throughout the sector. Issues like fear of change and lack of IPD awareness is the worst worry of industry members. Therefore, extreme need of education for academic people and relevant advertisements for industry members are necessary. Also, overcoming “fear of change”, requires time. As a recommendation for further studies, curriculum of capstone courses for IPD could be investigated.
- Developing project process measurement system by using a triple-metric algorithm. It means that define cost, schedule and quality as project metrics to measure the project performance. Whether, the project will be accomplished within time and within budget or not.
- Developing flowcharts to eliminate irrelevant answers or apply weight to authentic answer series. For example, generating bell shape curves for answers. Upper band and lower band bell shaped curves in order to control the answers. This will enhance the reliability of answers. Also, in questionnaire design phase, assigning controlling questions will help the researcher to eliminate the inappropriate responses.
- Correlation of this system with legal system of the country. Justify codes and conditions of AIA contractual templates for the region.
- Insurance issues related to IPD in each country.
- Application of IPD as delivery method, BIM as tool and LEAN construction as process of a project. Also application of these three different case studies and their comparisons.

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APPENDIX A. PERMISSIONS

UYGULAMALI ETİK ARAŞTIRMA MERKEZİ
APPLIED ETHICS RESEARCH CENTER

ORTA DOĞU TEKNİK ÜNİVERSİTESİ
MIDDLE EAST TECHNICAL UNIVERSITY

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14 Mayıs 2015

Gönderilen : Y.Doç.Dr. Aslı Akçamete Güngör
İnşaat Mühendisliği Bölümü

Gönderen : Prof. Dr. Canan Sümer
IAK Başkan Vekili

İlgili : Etik Onayı

Danışmanlığını yapmış olduğunuz İnşaat Mühendisliği bölümü öğrencisi Ali Sharefi Abadi'nin "Türk ve Orta Doğu Mimarlık Mühendislik İnşaat Sektörünün Bütünleşik Proje Yönetim Sistemine (IPD) Karşı Tutumu" isimli araştırması "İnsan Araştırmaları Komitesi" tarafından uygun görülerek gerekli onay verilmiştir.

Bilgilerinize saygılarımla sunarım.

Etik Komite Onayı

Uygundur

14/05/2015

Prof.Dr. Canan Sümer
Uygulamalı Etik Araştırma Merkezi
(UEAM) Başkan Vekili
ODTÜ 06800 ANKARA

S.n. Dr. A. Akçamete
27-5.15

ORTA DOĞU TEKNİK ÜNİVERSİTESİ
26 Mayıs 2015

Orta Doğu Teknik Üniversitesi İnsan Araştırmaları
Etik Kurulu Başvuru Formu Proje Bilgi Formu

1. Çalışmanızın ayrıntılı açıklamasını, hipotezlerinizi de içerecek şekilde yazınız.

Bu çalışmada farklı inşaat sektöründe olan firmalar, kurumlar ve akademik alanlarda çalışan insanlarla röportaj yapılacak ve/veya anket sunulacaktır. Gelen yanıtlar ve verilere dayanarak sektörün Bütünleşik Proje Yönetim Sistemi (IPD)'ni kabul etmesinin önündeki en büyük çelişkileri ve olası problemler araştırılacaktır. Bu problemlerin giderilmesi yönünde tavsiyeler ve çözümler sunulması hedeflenmektedir. Sektörün bu sistemi kabullenmek için yatkınlık derecesi araştırılarak, Bütünleşik Proje Yönetim Sistemi (IPD)'nin Yapı Bilgi Modellemesi (BIM) desteğiyle beraber kullanımının projenin ilerlemesinde nasıl kolaylıklar sunacağı sunulacaktır.

2. Veri toplama sürecinizi, kullanılacak yöntem, ölçek, araç ve teknikleri de içerecek şekilde yazınız. (Araştırmada Kullanılan her türlü ölçek ya da anketin bir kopyasını bu dokümanla birlikte teslim ediniz).

Araştırma kapsamında veriler ekte sunulan anket soruları ile toplanacaktır. Aynı sorular mülakat sürecinde seçilen firmalardan veri toplanmasında kullanılacaktır. Daha fazla firma ve çalışan görüşüne ulaşabilmek için hazırlanan anket internet üzerinden (METU Survey kullanılarak) katılımcılara ulaştırılacaktır.

3. Çalışmanızın beklenen sonuçlarını yazınız.

- Bütünleşik Proje Yönetimi sisteminin Türk ve Orta Doğu inşaat sektöründe adapte edilmesinin önündeki temel problemlerin belirlenmesi.
- Genel olarak inşaat ve yapı sanayisinde çalışanların yeni proje yönetim sistemlerine ne kadar açık olduklarının belirlenmesi.

4. Çalışmanız, katılımcıların fiziksel ve/ya ruhsal sağlığını tehdit edici ya da onlar için stres kaynağı olabilecek unsurları içermekte midir? Evet, ise, açıklayınız. Bu unsurların etkilerini ortadan kaldırmak ya da en aza indirmek için, alınacak önlemleri açıklayınız.

Hayır içermemektedir.

APPENDIX B. SURVEY QUESTIONS

Hosted by: Middle East Technical University survey (METU Survey service)



MIDDLE EAST TECHNICAL UNIVERSITY

METU Survey Service

Attitude of Turkish and Middle Eastern architectural – engineering – construction industry toward integrated project delivery

Created: May 15 2015, 2:46 PM

Last modified: May 30 2015 1:16 PM

Design theme: basic

Languages: English– Farsi – Turkish

The objective of this survey is to determine the impact that integrated project delivery (IPD) will have on the future of project delivery in the architectural – engineering – construction (AEC) industry of Turkish and Middle East and the general attitude of industry members toward this delivery system. After a wide review of recent studies and articles a list of factors has been compiled that may influence the rate and extent of the onset of IPD in the region. Worth mentioning here that each of questions designed with consultancy of research assistants in department of construction engineering and management of southern California state university and for a specific aim. A first group of questions ascertain the demographics of the industry members who respond. And the

second group of address the factors might affect acceptance and implementation of integrated project delivery.



MIDDLE EAST TECHNICAL UNIVERSITY

ATTITUDE OF TURKISH AND MIDDLE EASTERN AEC INDUSTRIES TOWARD INTEGRATED PROJECT DELIVERY

Dear Professionals,

I am currently pursuing my MSc Degree in Construction Engineering and Management at Middle East Technical University (METU). As a part of my thesis, I am undertaking a research to investigate the "Attitude of Turkish and Middle Eastern AEC Industries toward Integrated Project Delivery".

I would be grateful if you could spare a few minutes of your valuable time to answer the following questions.

The questionnaires will remain anonymous. Details of your name and email address are optional and these will not be published anywhere in the thesis submission or in further publications.

It would be highly appreciated if you could complete this questionnaire and return latest by 5th of July 2015 and I kindly request you to circulate this survey among your colleagues and experts in AEC.

Your response is integral to collating my research and your anticipated assistance is much appreciated.

Kind Regards

Ali Sharefi Abadi

M.S. Student

Department of Civil Engineering

Middle East Technical University (METU)

Ankara – Turkey

Email: alisharefi@gmail.com

ali.sharefiabadi@metu.edu.tr

There are 25 questions in this survey.

[Load unfinished survey](#)

[Next >>](#)

[Exit and clear survey](#)



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100%

MAIN SURVEY

• **1 A01 Which of the following best describes your role in the industry?**
Choose one of the following answers

- ☐ Owner
- ☐ Developer
- ☐ Architect
- ☐ Facilities Manager
- ☐ Engineer
- ☐ Subcontractor
- ☐ General Contractor
- ☐ Supplier / Manufacturer
- ☐ Consultant
- ☐ Educator
- ☐ Other:

• **2 A02 How many employees work at your firm?**
Choose one of the following answers

- ☐ Under 50
- ☐ 50-100
- ☐ 100 - 300
- ☐ 300 - 500
- ☐ 500 - 1000
- ☐ 1000 - 2000
- ☐ 2000+

• **3 A03 How many years of experience do you have in AEC sector?**
Choose one of the following answers

- ☐ Under 5 yrs.
- ☐ 5-9
- ☐ 10-19
- ☐ 20-29
- ☐ 30-39
- ☐ 40+

• **4 A04 Do you think there are issues with the current techniques that projects are delivered in the AEC industry ?**
Choose one of the following answers

- ☐ Yes
- ☐ No
- ☐ Not sure

• **5 A05 Please select each of the following Project Delivery Methods that you have had experience with:**
Check any that apply

- ☐ Design – Bid – Built (DBB)
- ☐ Design – Bid (DB)
- ☐ Construction Management at Risk (CM @ Risk)
- ☐ Construction Management for Fee (CM for Fee)
- ☐ Integrated Project delivery (IPD)
- ☐ Built – Operate – Transfer (BOT)
- ☐ Other:

• **6 A06** Are you currently (or have you in the past) been involved with a project that utilized Integrated Project Delivery (IPD) or some form of collaborative agreement?

- ☐ Yes ☐ No

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

• **7 A07** Are you familiar with IPD and its basic principles?

Choose one of the following answers

- ☐ Yes I'm experienced with IPD
☐ Yes I'm informed about IPD
☐ No

• **8 A08** Would you be interested in working on a project that uses IPD as a delivery method?

- ☐ Yes ☐ No

? Please answer this question and questions below based on what you know about IPD.

• **9 A09** Would you prefer IPD to other (traditional) delivery methods?

Choose one of the following answers

- ☐ Yes, because projects are delivered more efficiently
☐ Yes, because IPD avoids adversarial relationships
☐ No, because it doesn't work with my business model
☐ No, because the risks of adopting a new system are too high
☐ Not sure

• **10 A10** List forthcoming factors in the order of their importance to the success of an IPD project.

Click on an item in the list on the left, starting with your highest ranking item, moving through to your lowest ranking item.

Your choices:

Collaborative Team Spirit
 Compensation Linked to Project Outcome
 Early Team Formation
 Early Definition of Project Goals
 Appropriate Technology / Building Information Modeling (BIM)
 Lean Construction Methods
 Well-defined Contractual Relationships
 Clear Roles / Responsibilities
 Experience in Implementing IPD
 Willingness to Change

Your ranking:

1:	
2:	
3:	
4:	
5:	
6:	
7:	
8:	
9:	
10:	

Click on the scissors next to each item on the right to remove the last entry in your ranked list

? (1 being the most important)

• **11 A11** Please select all of the following contractual agreements that you believe IPD can be applied to. Check any that apply

- ☐ Design – Bid – Built (DBB)
☐ Design – Bid (DB)
☐ Construction Management at Risk (CM @ Risk)
☐ Construction Management for Fee (CM for Fee)
☐ Built – Operate – Transfer (BOT)
☐ It cannot be applied to any of these
☐ Not sure

• **12 A12** Please select all of the following concerns that you have about being involved with an IPD project

Check any that apply

- ☐ Do not trust other industry professionals enough to work with them as a team on a project
☐ Not enough evidence that risk allocation / insurance concerns have been addressed
☐ Industry use of technology / BIM is not advanced enough yet to support IPD as intended
☐ Not interested in sharing risk and reward with others
☐ Do not have any concerns about using IPD

• **13 A13** Have you been involved on a project where Building Information Modeling (BIM) was used?
Choose one of the following answers

- ☐ Yes I'm experienced with BIM
☐ Yes I'm informed about BIM
☐ No

• **14 A14** Please select all of the following BIM capabilities that you have used on a project.
Check any that apply

- ☐ Visualization of Form
☐ Construction Simulation
☐ Space Validation
☐ Design Collaboration
☐ Clash Detection
☐ Digital Fabrication
☐ Facilities Management
☐ Rule / Code Checking
☐ Environmental Analysis
☐ Model-Based Estimating
☐ Other:

• **15 A15**

Do you consider yourself (or your company) well-trained and capable enough to use BIM effectively on an IPD project?

Choose one of the following answers

- ☐ Yes
☐ No
☐ Not sure

• **16 A16**

In your opinion, is Building Information Modeling (BIM) a prerequisite for IPD?

Choose one of the following answers

- ☐ Yes
☐ No
☐ Not sure

• **17 A17**

Do you think IPD will someday become a widely embraced project delivery method in Turkey and Middle East?

Choose one of the following answers

- ☐ Yes
☐ No
☐ Not sure

• **18 A18**

List the following obstacles in the order of their hindrance to the widespread industry adoption of IPD. (1 being the biggest obstacle)

Click on an item in the list on the left, starting with your highest ranking item, moving through to your lowest ranking item.

Your choices:

Business Risk
Lack of IPD Awareness
Lack of Appropriate Legal Structure
Lack of Industry-wide Standardization
Limitations of Technology
Fear of Change

Your ranking:

1:
2:
3:
4:
5:
6:

Click on the scissors next to each item on the right to remove the last entry in your ranked list

• 19 A19

On a scale of 1 to 5, how easy / difficult was it to work with the other major parties in a traditional and non-collaborative setting?

	Most Easy	Easy	Neutral	Difficult	Most Difficult	No idea
DBB	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
DB	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
CM	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
IPD	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

• 20 A20

What kind of metrics do you use to determine project performance?

Choose one of the following answers

- ☐ Cost
☐ Schedule
☐ Quality
☐ Other:

• 21 A21

Please select all of the following parties that were involved in various stages of the project.

	Preliminary Design	Early Design	Design Development	Construction	Close-out	Facilities Management
Owner	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Architect	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Engineers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
General Contractor	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Subcontractors	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Manufacturers / Suppliers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

• 22 A22

Please select all of the following project types/sizes that you believe would work well with IPD.

Check any that apply

- ☐ All Types of Projects
☐ Large Projects
☐ Small Projects
☐ Medium Projects
☐ Commercial
☐ Cultural
☐ Residential
☐ Industrial
☐ Infrastructure
☐ Civic / Government
☐ Transportation
☐ Healthcare
☐ Education
☐ Other:

• 23 A23

how long will it take for IPD system to function properly in Turkey and Middle East AEC industry ?

Choose one of the following answers

- ☐ less than 5 years
☐ 5 ~ 10 years
☐ 10 ~ 15 years
☐ 15 ~ 20 years
☐ 20 ~ 25 years
☐ more than 25 years

• 23 A23

how long will it take for IPD system to function properly in Turkey and Middle East AEC industry ?

Choose one of the following answers

- ☐ less than 5 years
- ☐ 5 ~ 10 years
- ☐ 10 ~ 15 years
- ☐ 15 ~ 20 years
- ☐ 20 ~ 25 years
- ☐ more than 25 years

• 24 A24

What do you think the market share of IPD will be after it strats functioning properly in Turkey and Middle East ?

Choose one of the following answers

- ☐ less than 2%
- ☐ 2% ~ 5%
- ☐ 5% ~ 10%
- ☐ 10% ~ 20%
- ☐ 20% ~ 30%
- ☐ more than 30%

25 A25 Personal Information

Name :	<input type="text"/>
Company/University :	<input type="text"/>
Title :	<input type="text"/>
Email :	<input type="text"/>
Phone :	<input type="text"/>

پرسشنامه اصلی

* **A01 1** از گزینه های موجود کدامیک بهترین توصیف برای موقعیت شغلی کنونی شما می باشد ؟
یکی از پاسخ های زیر را انتخاب کنید

- ☐ کارفرما
- ☐ توسعه دهنده
- ☐ معمار
- ☐ مدیر تسهیلات
- ☐ مهندسی
- ☐ پیمانکار جز
- ☐ پیمانکار
- ☐ عرضه کننده / سازنده
- ☐ مشاور
- ☐ اکادمیک
- ☐ شیره:

* **A02 2** تعداد افراد شاغل در محل اشتغال شما چند نفر می باشد ؟
یکی از پاسخ های زیر را انتخاب کنید

- ☐ کمتر از 50
- ☐ 50 - 100
- ☐ 100 - 300
- ☐ 300 - 500
- ☐ 500 - 1000
- ☐ 1000 - 2000
- ☐ 2000 +

* **A03 3** در صنعت ساختمان صاحب چند سال سابقه کاری می باشید ؟
یکی از پاسخ های زیر را انتخاب کنید

- ☐ کمتر از 5 سال
- ☐ 5-9
- ☐ 10-19
- ☐ 20-29
- ☐ 30-39
- ☐ 40+

* **A04 4** در حالت کلی آیا در صنعت ساختمان (معماری-مهندسی-ساخت) مشکلاتی مربوط به سیستمهای تحویل پروژه وجود دارند ؟
یکی از پاسخ های زیر را انتخاب کنید

- ☐ بله
- ☐ خیر
- ☐ مطمئن نیستم

* **A05 5** سیستمهای تحویل پروژه ای که تاکنون کارکرده اید کدامند ؟
هر موردی را که برقرار است، انتخاب کنید

- ☐ DBB طراحی-مناقصه-ساخت
- ☐ DB طرح-ساخت
- ☐ CM @ Risk مدیر ساخت در معرض ریسک
- ☐ CM for Fee مدیریت ساخت حق الزحمه ای
- ☐ IPD تحویل پروژه یکپارچه
- ☐ BOT ساخت-بهره برداری-انتقال
- ☐ شیره:

• **A06 6** آیا ناکوت(ویا هم اکبوت) تجربه کار درسیستم تحویل پروژه یکپارچه و باهرگونه سیستم مشارکتی راداشته اید؟

بلی ☐ خیر ☐

? با توجه به تعریف انیستیتوی معماران آمریکا : سیستم تحویل پروژه یکپارچه رویکردی به اجرای پروژه است که عوامل ساختارهای تجاری ،سیستمها و افراد را در یک فرایند یکپارچه می کنداین فرایند مشارکتی به منظور بهینه کردن نتایج پروژه،افزایش ارزش پروژه برای مالک ،کاهش اتلاف و حداکثر کردن کارایی در تمام فازهای پروژه ،از استعدادها و بینش جمعی تمام عوامل پروژه استفاده می کند .

• **A07 7** آیا باسیستم تحویل پروژه یکپارچه و اصول بنیادین آن آشنایی دارید؟ یکی از پاسخ های زیر را انتخاب کنید

بله ؛ تجربه کار با سیستم تحویل پروژه یکپارچه را دارم ☐
بله ؛ اطلاعاتی مبنی بر سیستم تحویل پروژه یکپارچه دارم ☐
خیر ☐

• **A08 8** آیا به اشتغال در پروژه ای که در آن سیستم تحویل پروژه یکپارچه به کار گرفته شده است علاقه مندید ؟

بلی ☐ خیر ☐

? برحسب معلوماتی که در مورد سبتم تحویل پروژه یکپارچه دارید به سوالات زیر پاسخ دهید.

• **A09 9** آیا سیستم تحویل پروژه یکپارچه را به سایر سیستم های تحویل پروژه موجود ترجیح می دهید؟ یکی از پاسخ های زیر را انتخاب کنید

بله؛ چون پروژه ها بطور موثرتر و پر بازده تر تحویل داده می شوند ☐
بله؛ چون سیستم تحویل پروژه یکپارچه از روابط خصمانه جلوگیری می کند ☐
خیر ؛ چون این سیستم با مدل تجاری من همخوانی ندارد ☐
خیر ؛ چون ریسک پذیرش کار با یک سیستم کاری جدید بسیار بالاست ☐
مطمئن نیستم ☐

• **A10 10** کدامیک از فاکتورهای زیر برای موفقیت یک پروژه با سیستم تحویل پروژه یکپارچه دارای اهمیت بیشتری می باشد به ترتیب اولویت از بالا به پایین بر روی اینم های لیست کلیک نمایید

رتبه شما؟	انتخاب شما؟
1:	روحه کار گروهی
2:	سیستم پرداخت مبنی بر نتایج پروژه
3:	تشکیل تیم زودهنگام
4:	تعریف زودهنگام اهداف پروژه
5:	فناوری مناسب / مدل سازی اطلاعات ساختمان (BIM)
6:	هند های روش ساخت ناب lean construction
7:	روابط قراردادی تعریف شده به نحو احسن
8:	نقشه ها و مسئولیت های تعریف شده به نحو احسن
9:	تجربه اجرایی از IPD
10:	تعامل به تغییر

برای حذف آخرین مورد از لیست اولویت بر روی قیچی کلیک کنید

?

(شماره یک بهترین فاکتور می باشد)

• **A11 11** به نظر شما سیستم تحویل پروژه یکپارچه را به کدامیک از سیستمهای تحویل پروژه موجود میتوان اعمال کرد؟ هر موردی را که برقرار است، انتخاب کنید

☐ (DBB) طراحی-مناقصه-ساخت
☐ (DB) طرح-ساخت
☐ (CM @ Risk) مدیر ساخت در معرض ریسک
☐ (CM for Fee) مدیر ساخت به حق الزحمه ای
☐ (BOT) ساخت-بهره برداری-انتقال
☐ قابل اعمال به هیچیک از اینها نمی باشد
☐ مطمئن نیستم

* **A12 12** نگرانی‌های مربوط به جای گرفتن در یک پروژه که در حال انجام با سیستم تحویل پروژه یکپارچه است دارید را انتخاب کنید
هر موردی را که برقرار است، انتخاب کنید

- ☐ به سایر متخصصین در صنعت ساختمان به اندازه کافی اعتماد ندارم
- ☐ شواهد کافی مبنی بر اینکه مشکلات مربوط به امور تخصیص ریسک و بیمه برطرف شده است موجود نمی باشد
- ☐ پیشرفت تکنولوژیکی و BIM برای پوشش سیستم های تحویل پروژه یکپارچه کافی نمی باشد
- ☐ به اشتراک گذاری ریسک و پاداش با دیگران مشتاق نیستم
- ☐ هیچگونه نگرانی ندارم

* **A13 13** آیا تاکنون در پروژه ای که نرم افزار و یا سیستم مدلسازی اطلاعات ساختمان (BIM) بکارگرفته شده است کارکرده اید ؟
یکی از پاسخ های زیر را انتخاب کنید

- ☐ آری تجربه کاری داشته ام
- ☐ آری درباره این سیستم مطلع هستم
- ☐ خیر

* **A14 14** قابلیت‌ها و کارایی های نرم افزار و یا سیستم مدلسازی اطلاعات ساختمان که از آنها در پروژه بهره جسته اید را انتخاب بفرمائید
هر موردی را که برقرار است، انتخاب کنید

- ☐ شبیه سازی سه بعدی
- ☐ شبیه سازی پروسه ساخت
- ☐ اعتبار سنجی فضاها
- ☐ طراحی مشترک
- ☐ تشخیص اتوماتیک تداخل ها
- ☐ ساخت دیجیتال
- ☐ مدیریت تسهیلات
- ☐ چک کردن مفاد و قوانین
- ☐ تجزیه و تحلیل زیست محیطی
- ☐ برآوردهای مدل مبنا
- ☐ غیره:

* **A15 15** آیا آموزش و ظرفیت های خود (و یا شرکت خودتان) را جهت بکار بستن سیستم مدلسازی اطلاعات ساختمان (BIM) جهت انجام پروژه مشارکتی (IPD) کافی می بینید ؟
یکی از پاسخ های زیر را انتخاب کنید

- ☐ بله
- ☐ خیر
- ☐ مطمئن نیستم

* **A16 16** به نظر شما آیا سیستم (و یا نرم افزارهای) مدلسازی اطلاعات ساختمان (BIM) برای سیستم تحویل پروژه یکپارچه (IPD) یک پیشنیاز اساسی می باشد ؟
یکی از پاسخ های زیر را انتخاب کنید

- ☐ بله
- ☐ خیر
- ☐ مطمئن نیستم

* **A17 17** آیا بر این باور هستید که سیستم تحویل پروژه یکپارچه در آینده ای نزدیک مورد توجه صنعت ساختمان در منطقه خاور میانه قرار خواهد گرفت ؟
یکی از پاسخ های زیر را انتخاب کنید

- ☐ بله
- ☐ خیر
- ☐ مطمئن نیستم

A18 18 *

موانع زیر را به ترتیب درجه اهمیت آنها از نقطه نظر جلوگیری از فراگیر شدن سیستم تحویل پروژه یکپارچه در خاور میانه را اولویت بندی کنید. (شماره یک مهمترین می باشد)

به ترتیب اولویت از بالا به پایین بر روی آیتم های لیست کلیک نمایید

انتخاب شما:

1: مخاطرات تجاری

2: نقصان آگاهی از سیستم تحویل پروژه یکپارچه

3: نقصان ساختار قانونی متناسب

4: نقصان استانداردهای جامع برای این سیستم در صنعت ساختمان

5: محدودیت های تکنولوژیکی

6: واصله از تشییر

رتبه شما:

1:

2:

3:

4:

5:

6:

برای حذف آخرین مورد از لیست اولویت بر روی قبضه کلیک کنید

A19 19 *

در سیستمهای تحویل پروژه متعارف در مقیاس صفر تا ده همکاری با سایر ارگانهای اصلی را به چه میزان راحت / سخت ارزیابی می کنید؟(10سختترین)

نظری ندارم	خیلی سخت	سخت	متوسط	راحت	خیلی راحت	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	DBB
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	DB
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	CM
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	IPD

A20 20 *

در مدت زمان انجام پروژه هرگونه مشکلات پیش بینی نشده ناشی از نقصان قرارداد را تجربه کرده اید ؟ بطور مختصر شرح دهید یکی از پاسخ های زیر را انتخاب کنید

☐ بله

☐ خیر

☐ مطمئن نیستم

☐ غیره:

A21 21 *

به منظور ارزیابی عملکرد و کارایی پروژه چه نوع معیارهای ابتاد و یا استفاده کرده اید؟

یکی از پاسخ های زیر را انتخاب کنید

☐ مالی

☐ زمانی

☐ کیفیتی

☐ غیره:

A22 22 *

در کدام مرحله از پروسه یک پروژه ؛ کدامین پارتنی وارد چرخه می شود ؟

مدیریت و بهره برداری تسهیلات	اتمام	ساخت	طراحی	طراحی اولیه	فاز مطالعاتی	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	کارفرما
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	معماری
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	محاسبه - مهندسی
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	پیمانکار
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	پیمانکار جز
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	تولید کننده / عرضه کننده

A23 23 *

تمام انواع پروژه / مقیاس های زیر که با سیستم تحویل پروژه یکپارچه بتوی همخوانی می کنند را انتخاب کنید

هر موردی را که برقرار است، انتخاب کنید

- ☐ هر نوع پروژه
- ☐ پروژه های بزرگ
- ☐ پروژه های متوسط
- ☐ پروژه های کوچک
- ☐ تجاری
- ☐ فرهنگی
- ☐ مسکونی
- ☐ صنعتی
- ☐ زیرساختی
- ☐ دولتی/ملی
- ☐ ترابری
- ☐ بهداشتی و درمانی
- ☐ آموزشی

☐ شماره:

A24 24 شروع به استفاده از سیستم تحویل پروژه یکپارچه چند سال طول خواهد کشید؟ یکی از پاسخ های زیر را انتخاب کنید

- ☐ کمتر از 5 سال
- ☐ 5 - 10
- ☐ 10 - 20
- ☐ 20 - 30
- ☐ 30 - 40
- ☐ بیش از 40 سال

A25 25 * بعد از شروع بکارگیری سیستم تحویل پروژه یکپارچه در کشور های خاور میانه ؛ این سیستم چه سهمی از بازار را در اختیار خواهد داشت ؟ یکی از پاسخ های زیر را انتخاب کنید

- ☐ کمتر از 5 درصد
- ☐ 2% ~ 5%
- ☐ 5% ~ 10%
- ☐ 10% ~ 20%
- ☐ 20% ~ 30%
- ☐ بیش از 30 درصد

A26 26 اطلاعات شخصی

<input type="text"/>	نام و نام خانوادگی
<input type="text"/>	شرکت / دانشگاه
<input type="text"/>	عنوان
<input type="text"/>	آدرس پست الکترونیک
<input type="text"/>	تلفن

[خروج از صفحه و پاک کردن نظرسنجی](#)

[ارسال](#)

[>> قبلی](#)

[بعداً از سرگیری شود](#)



0%
100%

ANA ANKET

• **1 A01** Altta yeralan gruplardan hangisi bulunduğuz pozisyonu daha iyi tanımlıyor?
Aşağıdaki yanıtlardan birini seçiniz

- ☐ İşveren
- ☐ geliştirmen/Geliştirici
- ☐ Mimar
- ☐ Tesis Yöneticisi
- ☐ Mühendis
- ☐ Taşeron
- ☐ Müteahhit
- ☐ Tedarikçi / Üretici
- ☐ Müşavir
- ☐ Akademisyen
- ☐ Diğer:

• **2 A02** Firmanızda kaç çalışan var ?
Aşağıdaki yanıtlardan birini seçiniz

- ☐ 50 den az
- ☐ 50 - 100
- ☐ 100 - 300
- ☐ 300 - 500
- ☐ 500 - 1000
- ☐ 1000 - 2000
- ☐ 2000 +

• **3 A03** Sektörde kaç yıllık deneyiminiz var ?
Aşağıdaki yanıtlardan birini seçiniz

- ☐ 5 den az
- ☐ 5-9
- ☐ 10-19
- ☐ 20-29
- ☐ 30-39
- ☐ 40+

• **4 A04**
Sizce yaygın olarak kullanılmakta olan geleneksel proje teslim sistemlerinde problemler var mı?

Aşağıdaki yanıtlardan birini seçiniz

- ☐ evet
- ☐ hayır
- ☐ emin değilim

• 5 A05 Lütfen şimdiye kadar çalışmış olduğunuz proje teslim yöntemlerini seçiniz :
Uyanların tümünü seçiniz.

- ☐ Tasarla-Teklif Ver- İnşaa Et (DBB)
- ☐ Tasarla-Yap (DB)
- ☐ Yapım Yönetimi/İnşaat Yöneticisi (CM for Fee)
- ☐ İşveren Vekili (CM at Risk)
- ☐ Bütünleşik Proje Teslimi (IPD)
- ☐ Yap-İşlet -Devret (BOT)
- ☐ Diğer:

• 6 A06 Şu anda (veya şimdiye kadar) IPD veya ortaklık anlaşması (collaborative agreement) içeren bir projede yer aldınız mı ?

- ☐ Evet ☐ Hayır

? Amerikan Mimarlar Enstitüsü (AIA) şu anda Bütünleşik Proje Teslimi ni (IPD) "insanları, sistemleri, iş yapılarını ve uygulamalarını, tasarım, üretim ve inşaa süreçlerinin tümünde gerçekleştirilen israfı önlemek ve etkinliği optimize etmek için tüm katılımcıların yeteneklerinden ve içgörülerinden ortaklaşa faydalanarak birleştiren bir proje teslim yöntemidir " şeklinde tanımlamaktadır.

• 7 A07 IPD ve temel prensipleri hakkında bilginiz var mı ?
Aşağıdaki yanıtlardan birini seçiniz

- ☐ Evet IPD deneyimim var
- ☐ Yalnızca bilgi sahibiyim
- ☐ Hayır

• 8 A08 Proje teslim yöntemi IPD olan bir projede çalışmak ister misiniz ?

- ☐ Evet ☐ Hayır

? Bütünleşik Proje Teslim sistemi hakkında olan bilgilerinize dayanarak aşağıda yer alan soruları cevaplayınız.

• 9 A09 IPD yi mevcut geleneksel proje teslim sistemlerine tercih eder misiniz ?
Aşağıdaki yanıtlardan birini seçiniz

- ☐ Evet , çünkü projeler daha verimli bir şekilde teslim ediliyor
- ☐ Evet , çünkü IPD muhalif ilişkileri önüyor
- ☐ Hayır , çünkü benim iş modelime uygun değil
- ☐ Hayır , çünkü yeni sistemlerle uyum sağlamanın riski çok yüksek
- ☐ Emin değilim

• 10 A10 IPD projesinin başarısı için önem derecesine dayanarak ,aşağıda yer alan faktörleri sıralayınız.
Soldaki listede, en yüksek dereceli öğeden başlayarak en düşük dereceli öğeye doğru sırayla tıklayınız.

Seçimleriniz:	Derecelendirmeniz:
<div>İşbirlikçi Ekip Ruhu</div> <div>Proje Sonucuna Bağlı Tazminat</div> <div>Erken Ekip Oluşumu</div> <div>Proje Hedeflerinin erken Tanımlanması</div> <div>Uygun Teknoloji / Yapı Bilgi Modellemesi (BIM)</div> <div>Yalın İnşaat Metodları</div> <div>İyi Tanımlanmış Sözleşmesel İlişkiler</div> <div>Açık Roller / Sorumluluklar</div> <div>IPD Uygulama Deneyimi</div> <div>Değişmeye İsteklilik</div>	1:
	2:
	3:
	4:
	5:
	6:
	7:
	8:
	9:
	10:

Sıralanmış listenizden son öğeyi çıkarmak için her öğenin sağ yanındaki makasa tıklayınız.

? (1 en önemli olmak üzere)

• **11 A11 -IPD, aşağıda yer alan metodların hankısına uygulanabilir Uyanların tümünü seçiniz.**

- ☐ Tasarla-Teklif Ver-İnşaa Et (DBB)
- ☐ tasarla-Yap (DB)
- ☐ Yapım Yönetimi/İnşaat Yöneticisi (CM for Fee)
- ☐ İşveren Vekili(CM at Risk)
- ☐ Yap-İşlet -Devret (BOT)
- ☐ Hiç birisine uygulanamaz
- ☐ Emin değilim

• **12 A12 Bir IPD projesinde yer almakla ilgili kaygılarınız nelerdir? Uyanların tümünü seçiniz.**

- ☐ Sektörde olan diğer profesyonellerle eşit takım olarak çalışacak güveni duymuyorum
- ☐ Risk tahsisi / sigorta kaygılarının ele alındığının garantisi yok
- ☐ Sektörde teknoloji /BIM kullanım halâ IPD yi desteklemek için yetersiz
- ☐ Risk ve mükafatı paylaşmak istemiyorum
- ☐ IPD kullanımıyla ilgili hiç bir kaygım yoktur

• **13 A13 Şimdiye kadar Yapı Bilgi Modellemesinin (BIM) kullanıldığı bir projede yer aldınız mı ? Aşağıdaki yanıtlardan birini seçiniz**

- ☐ Evet BIM ile ilgili deneyimim var
- ☐ Yalnızca bilgi sahibiyim
- ☐ Hayır

• **14 A14 Bir projede kullanmış olduğunuz Yapı Bilgi Modellemesi (BIM) becerilerini seçiniz. Uyanların tümünü seçiniz.**

- ☐ Formun Görselleştirmesi
- ☐ İnşaat Simülasyonu
- ☐ Alan doğrulama
- ☐ Tasarım Ortaklığı
- ☐ Çatışma Algılama Tesbiti
- ☐ Dijital Fabrikasyon
- ☐ Tesis Yönetimi
- ☐ Kural / Kod Denetleme
- ☐ Çevre Analizi
- ☐ Model Tabanlı Keşif/Metraj
- ☐ Diğer:

• **15 A15 Kendinizi (ve ya şirketinizi) Yapı Bilgi Modelleme Sistemini (BIM) IPD projesinde uygulamak için yeterli görüyor musunuz ? Aşağıdaki yanıtlardan birini seçiniz**

- ☐ Evet
- ☐ Hayır
- ☐ Emin değilim

• **16 A16 Sizce, Yapı Bilgi Modellemesi (BIM); Bütünleşik Proje Teslim (IPD) yöntemi için bir ön koşul mudur? Aşağıdaki yanıtlardan birini seçiniz**

- ☐ Evet
- ☐ Hayır
- ☐ Emin değilim

- 17 A17
Bütünleşik Proje Teslim (IPD) yönteminin ; gelecekte Türkiye ve Orta Doğuda yaygın bir proje teslim yöntemi olacağını düşünüyor musunuz ?

Aşağıdaki yanıtlardan birini seçiniz

- ☐ Evet
☐ Hayır
☐ Emin değilim

- 18 A18
Sanayinin IPD yi yaygın olarak kabul etmesi açısından engelleri sıralayınız (1 en büyük engel olmak üzere)

Soldaki listede, en yüksek dereceli öğeden başlayarak en düşük dereceli öğeye doğru sırayla tıklayınız.

Seçimleriniz:	Derecelendirmeniz:
İş Riskleri	1:
IPD Farkındalık Eksikliği	2:
Uygun Hukuksal Yapı Eksikliği	3:
Sanayi Çapında Standardizasyon Eksikliği	4:
Teknoloji Yetersizliği	5:
Değişim Korkusu	6:

Sıralanmış listenizden son öğeyi çıkarmak için her öğenin sağ yanındaki makasa tıklayınız.

- 19 A19 1-5 ölçeğinde geleneksel proje teslim yöntemlerinde diğer ana paydaşlarla çalışmayı ne kadar zor/kolay buluyor sunuz? (10 en zor olmak üzere)

	En kolay	Kolay	Nötür	Zor	En zor	Fikrim yok
DBB	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
DB	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
CM	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
IPD	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

- 20 A20
Proje süresince ortaya çıkan herhangi bir beklenmedik sözleşmesel konular / sorunlar var mıydı? Eğer öyleyse, kısaca açıklayınız lütfen!

Aşağıdaki yanıtlardan birini seçiniz

- ☐ Evet
☐ Hayır
☐ Emin değilim
☐ Diğer:

- 21 A21 proje performansını belirlemek için ne tür ölçütler kullanıyor sunuz?
Aşağıdaki yanıtlardan birini seçiniz

- ☐ Maliyet
☐ İş programı
☐ Kalite
☐ Diğer:

- 22 A22 Projenin çeşitli aşamalarında projede yer alan paydaşların Tümünü seçiniz.
(hangi paydaş hangi aşamada devreye girmektedir)

	Ön tasarım	Avan Proje	Kesin Proje	Yapım	Tasfiye	Tesis Yönetimi
İş veren	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mimar	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mühendisler	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Müteahhit	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Taahhütçüler	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Üreticiler / Tedarikçiler	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

• 23 A23 Sizce Bütünleşik Proje Teslim (IPD) yöntemiyle aşağıda yer alan proje türleri/boyutlarının hangisi daha iyi uyum sağlayabilir !? Uyanların tümünü seçiniz.

- ☐ Tüm Proje Çeşitleri
- ☐ Büyük ölçekli projeler
- ☐ Orta ölçekli Projeleri
- ☐ Küçük ölçekli Projeleri
- ☐ Ticari
- ☐ Kültürel Projeleri
- ☐ Konut Projeleri
- ☐ Endüstriyel Projeler
- ☐ Altyapı Projeleri
- ☐ Kentsel Projeler
- ☐ Ulaşım Projeleri
- ☐ Sağlık Hizmeti Projeleri
- ☐ Eğitim Projeleri
- ☐ Diğer:

24 A24 IPD sisteminin uygulanmaya başlanması kaç sene sürer ? Aşağıdaki yanıtlardan birini seçiniz

- ☐ 5 sene den az
- ☐ 5 ~ 10
- ☐ 10 ~ 20
- ☐ 20 ~ 30
- ☐ 30 ~ 40
- ☐ 40 sene den daha fazla

• 25 A25 IPD sistemi Türkiye ve Orta Doğu ülkelerinde uygulanmaya başladıktan sonra , pazarının yüzde kaçını elde edecektir ? Aşağıdaki yanıtlardan birini seçiniz

- ☐ 2% den daha az
- ☐ 2% ~ 5%
- ☐ 5% ~ 10%
- ☐ 10% ~ 20%
- ☐ 20% ~ 30%
- ☐ 30 % den daha fazla

26 A26 KİŞİSEL BİLGİLER

İsim soyisim :
Firma / üniversite :
Unvanınız :
Email :
telefon :

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