

## Article

# Application of Integrated Project Delivery (IPD) in the Middle East: Implementation and Challenges

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**Abstract:** The Integrated Project Delivery method (IPD) is a contractual framework that features enhanced collaboration, risk and reward sharing under a single contract among the major project parties. This delivery method is gaining popularity in the US and other parts of the world, due to its proven results in efficient risk and cost sharing. Despite that, no significant investigations have been made to address the adaptability of the Middle East construction sector to the IPD delivery system. The objective of this research is to investigate the level of preparedness Middle Eastern markets have for adoption of the IPD delivery system. First, a thorough literature review was carried out to identify common barriers and enablers of applying IPD in construction. Second, a survey was carried out to assess and rank such barriers and enablers as they specifically apply to the Middle East construction sector. Third, through structured interviews with contract experts, strategies and guidelines were devised to be used by Middle East owners, consultants, and contractors who have the intention to implement the IPD delivery method in their projects. Finally, a thorough comparison was made between two major Middle Eastern countries, Egypt and the Kingdom of Saudi Arabia (KSA), in terms of IPD application. The findings reveal that the main barriers to implementing IPD stem from cultural resistance to the new system and lack of knowledge about it. The subsequent strategies outlined by the research are expected to help the construction industry in the Middle East gain more depth of knowledge about the benefits and application of IPD.

**Keywords:** Integrated Project Delivery; Middle East; construction



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## 1. Introduction

Project delivery methods are important factors affecting the coordination, collaboration, qualitative and quantitative progress update, performance, overall duration, and cost of construction projects [1,2]. Some examples of traditional project delivery methods are: (1) Design-Bid-Build (DBB), where the client prepares separate contractual agreements with different entities for the design, consultancy and construction of a project; (2) Design Build (DB), where the client arranges one contractual agreement with an entity responsible for the construction of the project and for the design, which is executed inside the organization itself, or by a certain subcontractor which the entity will be responsible for; (3) Construction Manager at Risk (CMAR); where the Construction Manager (CM) is committed to deliver the project within a Guaranteed Maximum Price (GMP), and several other delivery methods. All these traditional approaches have effectively dominated the construction project delivery system for decades, but these approaches have disadvantages that need to be tackled [3–5]. Examples of these traditional system disadvantages are illustrated in the following, Table 1.

**Table 1.** Examples of traditional project delivery systems' disadvantages.

Definition	Illustration	Effect	Source
Separation Hierarchies	Large number of different contracts are arranged between the owner, main contractor, project management, consultant, subcontractors, etc.	<ul style="list-style-type: none"> <li>Each stakeholder attempts to optimize his or her own profit, resources, and progress with minor consideration to other stakeholders' interests.</li> <li>Non-collaborative medium is created inside the project's environment.</li> </ul>	[6]
Risk Transfer	Each party tries to transfer risk to the counterparty, rather than introducing methods to mitigate the risk itself.	<ul style="list-style-type: none"> <li>Conflicts arise and lots of negotiations take place with no solutions.</li> <li>Deliverables are not easily defined and there is misconduct in some product responsibilities.</li> </ul>	[7]
Interconnected Deliverables	Construction projects' outcomes are very interconnected and have different dependencies among involved stakeholders.	<ul style="list-style-type: none"> <li>Each single contract of different stakeholders does not completely contain all the required interconnected tasks.</li> <li>Increase in the number of contract addendums and amending agreements to cover interconnected objectives.</li> </ul>	[8]

The examples shown in the previous table were selected based on their evidenced direct impacts on the construction market in the Middle East; this market is immense in terms of investments, labor and durations, and these examples represent important challenges in the construction project's delivery process. Also, through the literature review, these examples presented the highest probability of occurrence in the construction markets of Middle Eastern countries.

To tackle the problems and risks associated with traditional delivery methods, researchers and practitioners have introduced the Integrated Project Delivery (IPD) method as a sufficient, collaborative, and strong delivery system. IPD develops an organization-based methodology for the collaboration of different stakeholders within the project from the initial stages and maintains this interconnected environment through the different subsequent stages of a project [9]. This system benefits the overall interest of the project, in terms of productivity, coordination, duration, and cost [10].

The American Institute of Architects (AIA) defines IPD as "a project delivery approach that integrates people, systems, business structures, and practices into a process that collaboratively harnesses the talents and insights of all project participants to optimize project results, increase value to the owner, reduce waste, and maximize efficiency through all phases of design, fabrication, and construction" [11]. This definition describes the strong dependency of IPD on collaboration and teamwork between all the different parties of a project. According to [12], the IPD type of contract can be similar in classification to Project Alliancing contracts, since both aim to achieve the same target of creating a collaborative, integrated environment between the different project entities and encourage coordination between the parties eventually delivering the project. Pertti L. [13] provided a detailed comparison between Project Partnering, Project Alliancing and IPD types of contracts in a relational parametric base. The differences are subtle, and they all share the same ideological basis of strong collaboration and interconnected targets among parties.

The compensation method for allocating gain/pain ratios across project participants, according to [14], is the most significant feature of implementing the IPD approach. The IPD method necessitates a collaborative contracting relationship, which motivates key team members to meet project goals. As a result, all parties should agree to multi-agreements to determine the appropriate compensation percentage for the project. The integration of BIM with IPD, according to [15], can improve overall outcomes of the design and construction processes because it is linked to numerous characteristics, such as cost/profit, schedule, safety, productivity, and relationships. Qiqi L. [16] offered extensive models for material,

equipment, and labor cash outflows using 5D BIM capabilities; however, the delivery strategy features were not examined. A comprehensive literature review is performed to investigate the most up-to-date BIM tools and capabilities in terms of schedule (4D BIM) and expense (5D BIM). Several techniques for leveraging BIM to produce dependable cash flow procedures have been published in the literature, as well as IPD's cost structure approach to effective BIM project delivery. A real-life case study is conducted to verify the validity and application of the suggested framework. Due to the fact that IPD is based on project participants sharing risk and rewards, it necessitates custom cash flow curves for the type of payment involved.

According to [17], applying IPD can improve construction project delivery timelines by decreasing waste through better planning and shared risk/rewards. As a result, optimizing 4D BIM can help reduce costs, while also improving overall efficiency of the construction process. According to [18], 4D BIM is a dynamic presentation of a design that considers time parameters, making it easier to understand than old techniques. Also, according to [19], multiparty agreement, early engagement of all parties, and shared risk and benefit are some of the elements that distinguish the utilizing of IPD in BIM projects. Furthermore, according to [20], BIM has improved the efficiency of the construction process, by facilitating collaboration among a diverse group of project participants at various stages, including design and construction. As a result, thorough decision-making must be considered early in the design process [21].

IPD has been proven to be a successful delivery method. Projects contracted through the IPD arrangement perform significantly better than those under DBB or DB agreements, because the IPD procurement strategy provides a model that allows all project participants to be involved from the conceptualization stage and evaluates the compensation approach in accordance with accountable participants [22]. According to [23], an alliancing agreement can reduce the risk of sharing information throughout project stages, because the risk management process's succession is normally dependent on data availability, and IPD enables this data by gathering all project participants at an early stage. Furthermore, according to [24], IPD has three limbs. Limb 1, reimbursement of project costs, in which project cost estimation must be examined utilizing an open book pricing scheme, requires that all projected expenditures to be incurred during the project implementation stages be included in this limb. Limb 2 represents all participants' overhead costs as well as the profit at risk proportion. Limb 3 represents profit at risk ratios, as well as cost savings.

Based on the completed literature review, and previous research cited in this study, the authors derived the following advantages and limitations of IPD contract implementation, represented in Table 2. These analysis points are based on studies conducted in different regions [5,7,8,11,13,14,16,22].

From Table 2, it appears that the limitations of IPD can be overcome through having strong experts, a detailed approach, and a completed contract based on trust between parties. This type of contract has been used in different projects worldwide and showed significant success and profit. Also, the advantages of using this type of contract are massive in terms of costs, risks, progress and duration.

Despite the success of IPD in the USA, Canada, Asia and Europe, the implementation of IPD in the Middle East is still fragile and weak. According to [25], implementation of the IPD concept has increased significantly in the last decade, despite its short introductory period; the highest trends appear in the United States, followed by Europe, then China and Iran. The objective of this research is to analyze Middle Eastern markets' preparedness to adopt IPD delivery, by exploring the different barriers of applying such a delivery method in Middle Eastern countries, comparing the results with other countries which are implementing IPD, and later proposing practices to overcome such barriers.

**Table 2.** Concise advantages and limitations of the IPD contract.

Characteristic	Description
Advantages	<b>Shared risk:</b> All the project parties are involved under the same contract with shared revenue and risks.
	<b>Minimum variation orders:</b> Project parties are involved in the early stages of the project, share information and progress together.
	<b>Minimum variation orders:</b> Project parties are involved in the early stages of the project, share information and progress together.
	<b>Lower cost:</b> Less variation orders and RFI lead to decreasing cost and better schedule.
	<b>Improved project profit:</b> The single contract can optimize the profit for all involved parties.
	<b>Better communication:</b> Different project parties can communicate better because all of them share the same objective.
Limitations	<b>Optimize materials' use and time:</b> Since everyone's profit depends on the project's overall success, everyone has an incentive to find the most efficient way to complete the task.
	<b>Large capital investment:</b> Project parties, such as owner, consultant, and contractor, need to have nearly equal capital investment in the project to accept sharing the risks.
	<b>Required expertise:</b> All parties need to have employees who understand different aspects of the project.
	<b>Balanced metrics:</b> The single contract approach requires balanced metrics for design, construction, cost, schedule, etc. to meet goals.
	<b>Conclusive insurance:</b> IPD contracts require substantial insurance, since all the risks are shared between the project parties.

## 2. Literature Review

In 2007, the American Institute of Architects (AIA) introduced the first comprehensive complete definition for the Integrated Project Delivery (IPD) contract, with the main objective of presenting all the stakeholders of a project in an integrated state, serving the overall interest of the project and its parties. This type of contract aims to use all the involved parties' expertise and construction knowledge in a multi-disciplinary contract that guarantees their fair participation in the project's income and risks [11]. There are different contracts that were written to support this method of project delivery. Especially prevalent in the USA is the AIA E202 contract. However, because of the existence of various conditions in the construction industry, such as different rules, permissions and agreements, these types of contracts were normally added, in the past, as an addendum or attachment to the project contract and conditions [26]. This was because the IPD type of contract required changes on the contractual level and agreements on the behavioral level to be integrated in the project's main contract and conditions [27].

According to the National Association of State Facilities Administrators [28], the following main principles of the IPD contract type are classified into *Contractual Principles* written in the project's agreements: Liability waivers between key participants, Fiscal transparency between key participants, Early involvement of key participants, Intensified design, Key participants bound together as equals, Shared financial risk and Reward based on project outcome, Jointly developed project target criteria, and Collaborative decision-making. The *Behavioral Principles* required for the overall interest of the project are choice-based principles, such as the following: Mutual respect and trust, Willingness to collaborate, and Open communication. Finally, the following *Catalysts* principles are necessary for facilitating IPD implementation and optimizing contract results: multi-party agreement, Building information modeling, Lean design and construction, and Co-location of team.

As mentioned before, the Contractual principles are bonded by the law and cannot be broken. These principles aim to distribute the project's risks and income mutually between all parties involved, which improves integration and builds a trust-based work environment [29]. The Behavioral principles entail rules for the integration of parties and

their communication. They attempt to improve the overall attitude of the participants and their negotiation and communication skills, which are very important factors affecting performance and effectiveness of different teams [30]. The Structural principles refer to process/system management; they define the rules that are needed to facilitate joint decisions and responsibilities. For example, team flexibility is needed in these cases, because negotiation and convincing require persuasive open minds for the right approach and decisions [30]. The final principles, the Technology principles refer to available delivery systems which have critical impact on project progress. The different use of Information Communication Technology (ICT) can increase the integration level, which improves progress and facilitates information sharing [31].

While motivation is one of the most important factors in IPD implementation, this depends on trust, respect, good leadership, strong team participation and valid work relations [32]. Trust is the main engine driving coordination between the different project stakeholders, and it requires time and multi-level cooperation to be achieved [33].

The barriers facing the implementation of IPD delivery can be classified into four categories according to [34]. These categories are modified to run alongside the four categories of IPD principles: Contractual, Behavioral, Structural and Technological. The modified **contractual** category encompasses lack of “IPD” insurance cover products, building without Guarantee Maximum Prices (GMP), contracts formed not tested, lack of new legal framework/ collaboration model, risk allocation mechanism, professional responsibility and licensing, challenge in selecting compensation /incentive structure, and dispute resolution. The modified **behavioral** category includes resistance to change, lack of confidence in project team, lack of IPD awareness, organization culture, business risk (return in investment), new approach taking time, and difficulty in measuring benefits. The modified **structural** category covers front-end investment, project characteristics, work process, formation of entity for “Real” IPD, scheduling issues, surrendering command and control, different criteria for procurement, and risk issues. Finally, the modified **technological** category concerns IT infrastructure, data protocol and copyright, lack of authority to restructure AEC procurement to enable an IPD model with advance technologies, and interoperability.

These four categories represent 27 factors from the literature affecting the adaptation of the IPD contract.

According to [34], the contractual barriers are those having a direct impact on the Contractual principles of the IPD contract. These problems affect the contractual bond between the parties and cause lack of liability in the multi-level contract. For example, the lack of an insurance cover plan decreases trust of stakeholders in the IPD contract, which negatively affects trust in the Risk/Reward distribution agreement among the different parties. Behavioral barriers represent the Cultural and Environmental factors which appear clearly in the behavioral acts of different parties in the construction field. This challenge appears in personal resistance to change, for example. People tend to depend on the types of contracts that they trust and refuse to change. Structural barriers are problems that center on opposing collaborative relations between members of different organizations and those inside the same organization. These barriers define the problems that may occur inside construction organization management and inside the system operating implementation of the IPD contract. Finally, the technological barriers are problems facing information sharing and gaining of information through the project life cycle. This information is strongly required for collaboration of different project trades and parties. As an example, [35] showed that the copyright of drawings, details and their processing protocols is essential to guarantee and protect the trust and liability of different project stakeholders in the IPD contract.

### 3. Research Methodology

This research is based on a quantitative approach where a questionnaire was completed by conducting interviews with managerial levels in different construction firms in the Middle East. Owners, consultants, and contractors having different construction

backgrounds were interviewed. Owners are concerned with investment and financial aspects, such as how much they need to spend, and project revenue. Consultants are mainly concerned with process safety, applicability, and durability. Finally, contractors are concerned with the costs of the project, duration, required resources, and logistical implementation aspects. These different backgrounds and experiences allow evaluation of IPD implementation and restraints from different points of view and assessment of how each entity sees the outcomes and process's barriers. The questionnaire was divided into two sets, each set having 14 question points to be answered. In the first set, the manager interviewed was asked to answer the questions based on the following point of view: "In your opinion and experience in the construction market, how do you rate the following challenges/barriers of implementing IPD contracting in the Middle East? In other words, how easy/difficult do you believe it will be for the market to overcome these barriers?". While in the second set, the manager should adopt the following different point of view: "In your company specifically, how willing is your company to overcome barriers to implementing the IPD contracting method?". The reason for creating these two different approaches of answering the questions is to identify how each individual classifies the willingness of his/her company and of other companies in the application of IPD, rating the IPD contract's constraints and recognizing the capabilities and resources of different companies that are needed for such contract implementation. The selected 14 question points about the implementation and constraints in each set were based on the previous literature review, overall study of the Middle East market and how each point is relevant, and the questions have a strong relation to the dynamic nature of the construction industry in the Middle East. The 14 question points are illustrated, with their proposed approach to overcoming barriers, in the following, Table 3. The answer to each point can be one of the following: Very difficult to overcome, Difficult to overcome, very easy to overcome and Easy to overcome.

**Table 3.** Question points included in the questionnaire.

Question Point	Significance (Proposed Approach to Overcome)
1 Resistance to Change	The parties involved need to have the tendency to change and experience new systems.
2 Risk Assignment	The process of determining the risks that each party will take responsibility for in the project.
3 Relative Capital Investment	The difference in capital head of the Owner, Consultant and Contractor can cause problems in agreements and risk sharing.
4 Contractual Legal Aspect	The IPD system imposes value-driven selection criteria, and this cannot ensure the lowest bidder and it also requires general agreement on One Single Contract.
5 Future Orientation	Individuals need to engage in future-oriented behaviors, such as delaying illumination, planning, and investing in the future.
6 Team Orientation	Teams need to be built effectively with implementation of a common purpose, or goal, among team members.
7 Participation	Leadership and managers need to involve others in making and implementing decisions (trusting relations between different parties).
8 In-Group Collectivism	Individuals need to express (and should express) pride, loyalty and cohesiveness to their organizations or parties.
9 Self-Protective approach	Individuals need to feel safe and secure in their organization.
10 Implementation of strict rules, policies, and regulations	Which lead to an individual becoming change averse.
11 Selecting compensation and incentive structure	Which depends on the unique characteristics of the project and its participants.
12 Technological BIM-based Aspects	Subcontractor does not have enough expertise with such technology, thus struggles to coordinate with the rest of the parties.
13 Expert Contract administrators	Experienced and willing to do the Integrated Project Delivery Approach.
14 Early Contractor Involvement	Early involvement in the design stage for constructability reviews. This means signing the contract with the contractor before the designs are complete.

#### 4. Results and Discussions

The results shown here are for the initial sample of 18 large-scale construction firms in Egypt and the Kingdom of Saudi Arabia (KSA) as representative countries of the Middle East (six representing contractors, six representing consultants, and six representing owners). The selection criteria were based on the reachability of highly professional managers and individuals, then the data was collected and analyzed using an iteration approach; each time the results were discussed and analyzed till the final overall results were concluded. The construction markets in Egypt and Saudi Arabia are massive because of ongoing development efforts in these two countries, according to several research. The current construction revolution that Egypt and the KSA are going through makes them strongly representative of the construction market in the Middle East. For example, Egypt is building its new capital and KSA is building hotels for the many tourists it receives each year. The companies represent a significant percentage of these markets where the authors are targeting a larger sample size as the study moves further.

At first glance, the sample size might not seem sufficient to draw reasonable conclusions. However, with further investigation and justification, the number of companies sampled is considered sufficient. The fact that the majority of construction professionals in the Middle East are unaware of IPD dictated the difficulty in selection of experts and companies to feed the research. The research team selected only top tier contract administrators (with experience of 20 plus years), representing the top firms in the regions, for the research to ensure reliable results. Also, only those with prior knowledge of partnering agreements were chosen. Even taking these factors into account, the research team had to explain in depth the concepts and philosophies of IPD to the participants and had to answer several questions asked by the participants about IPD before asking them to answer the survey questions. Within the discussions with the respondents, the research team had to ask them hidden questions (a sort of hidden oral test) to make sure they truly understood IPD. The answers of those who did not seem to grasp the concepts of IPD were not taken into consideration. Many hours were spent in finding, contacting, training, and interviewing the 18 experts about IPD.

##### 4.1. Barriers to Implementing IPD in the Middle East

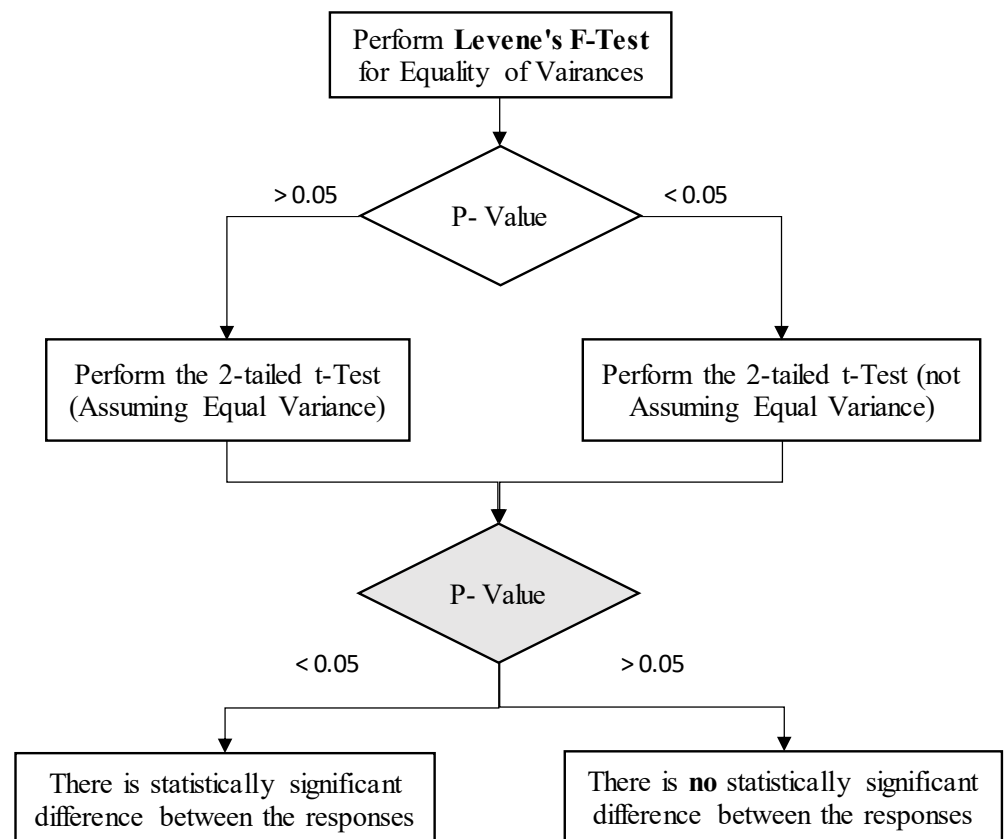
Table 4 shows a percentile scale ranking of the experts' opinions in each of the question points with respect to two different viewpoints: the Middle East Market and the Interviewee's Company. It gives an overall understanding of the difficulty of these constraints to the construction industry in the Middle East.

For comparison between the different sets throughout this study, a statistical comparison approach was used in the F-test, which is used to compare variance and standard deviation of two different samples, and the *t*-test, which is used to test whether there is a significant statistical difference between the two means of the studied samples or not [36]. These tests are easy to use and can show significant results. The implementation steps and result options are shown in Figure 1. The calculated probability (*p*-value) of the two tests is the factor determining the significant difference, where a value of less than 0.05 means that there is a statistically significant difference between the responses.

As shown in Table 5, the questionnaire points of analysis can be divided into two categories: those with the same results in both viewpoints and those with different results in each of the two viewpoints, depending on the F and *t*-tests (*p*-Value) described in the above section. This can provide insights for comparative analysis between the two viewpoints and how to connect each of them together to encourage and facilitate the implementation of an IPD contract.

**Table 4.** Percentile scale ranking of the expert opinions.

	Barriers	The Respondents' Views of the Middle Eastern Market				The Respondents' Views of their Own Companies			
		Very Difficult to Overcome (1)	Difficult to Overcome (2)	Easy to Overcome (3)	Very Easy to Overcome (4)	Very Difficult to Overcome (1)	Difficult to Overcome (2)	Easy to Overcome (3)	Very Easy to Overcome (4)
1	Resistance to Change	33%	61%	6%	0%	17%	72%	11%	0%
2	Risk Assignment	33%	28%	39%	0%	6%	44%	33%	17%
3	Relative Capital Investments	22%	44%	11%	22%	17%	50%	6%	28%
4	Contractual Leg. Aspect	28%	56%	6%	11%	11%	72%	11%	6%
5	Future Orientation	6%	50%	17%	28%	6%	39%	28%	28%
6	Team Orientation	28%	44%	11%	17%	17%	44%	22%	17%
7	Participation	11%	33%	17%	39%	11%	33%	11%	44%
8	In-Group Collectivism	17%	44%	22%	17%	6%	61%	17%	17%
9	Self-Protective approach	17%	28%	39%	17%	6%	50%	22%	22%
10	Implementation of strict rules and regulations	17%	33%	28%	22%	11%	50%	11%	28%
11	Selecting compensation and incentive structure	22%	44%	17%	17%	11%	28%	22%	39%
12	Technological BIM based Aspects	22%	11%	28%	39%	11%	39%	22%	28%
13	Expert Contract administrators	11%	28%	22%	39%	11%	39%	22%	28%
14	Early Contractor's Involvement	11%	44%	22%	22%	6%	72%	6%	17%

**Figure 1.** Procedure used to test and compare responses.



**Table 5.** Summarizing the Analysis results into two Categories.

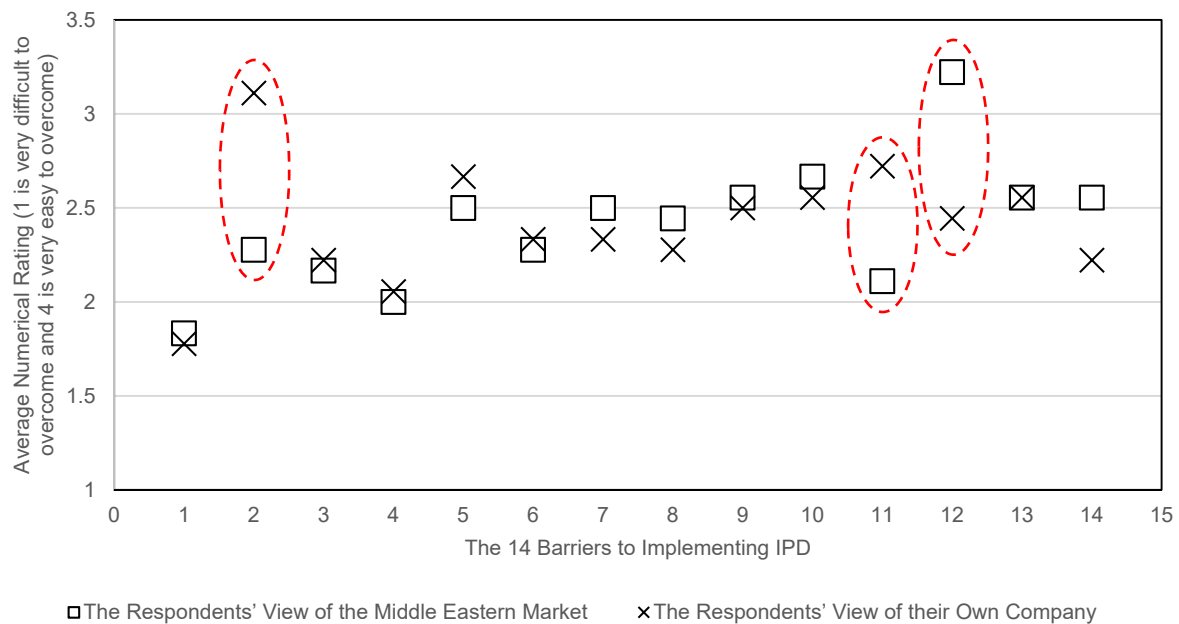
	Barriers to Implementing IPD	The Respondents' View of the Middle Eastern Market		The Respondents' View of their Own Company		<i>t</i> -Test ( <i>p</i> -Value)	Statistically Significant Difference?
		Avg.	Std. Dev.	Avg.	Std. Dev.		
1	Resistance to Change	1.83	0.50	1.78	0.63	0.78	FALSE
2	Risk Assignment	2.28	1.15	3.11	1.15	0.04	TRUE
3	Relative Capital Investments	2.17	0.69	2.22	0.79	0.83	FALSE
4	Contractual Legal Aspect	2.00	0.75	2.06	0.70	0.82	FALSE
5	Future Orientation	2.50	0.76	2.67	0.82	0.54	FALSE
6	Team Orientation	2.28	0.80	2.33	1.00	0.86	FALSE
7	Participation	2.50	0.76	2.33	0.67	0.50	FALSE
8	In-Group Collectivism	2.44	0.90	2.28	0.56	0.52	FALSE
9	Self-Protective approach	2.56	1.01	2.50	0.60	0.85	FALSE
10	Implementation of strict rules, policies, and regulations	2.67	1.11	2.56	0.83	0.74	FALSE
11	Selecting compensation and incentive structure	2.11	0.74	2.72	0.80	0.03	TRUE
12	Technological BIM-based Aspects	3.22	1.13	2.44	0.96	0.04	TRUE
13	Expert Contract administrators	2.56	0.83	2.56	0.96	1.00	FALSE
14	Early Contractor Involvement	2.56	0.83	2.22	0.53	0.17	FALSE

The points with different results in each viewpoint indicate that there is a lack of communication between different construction firms and this loss in communication increases the difficulty of implementing an IPD contract. Events and conferences bringing together people from different firms provide opportunities to share different opinions, capabilities, and methods to facilitate the implementation of new innovative approaches, like the IPD contract. For example, most experts in this research believe that the “Selecting compensation and incentive structure” constraint is Difficult to overcome in the Middle East market. However, the same experts see that the same “Selecting compensation and incentive structure” constraint is Easy to overcome inside their specific companies. This means that there is a strong capability to overcome this constraint and all that is missing is strong communication and collaboration channels between the different companies, and effective arrangements between them for the sharing of different relevant information, knowledge, and competencies for the implementation of IPD contracts. One constraint that opposes this view of opinions is the “Self-Protective approach”, which shows that, despite this being an easy obstacle to overcome, different construction companies’ strict hierarchy policies can make individuals afraid to express themselves more openly. Another opposing constraint is “Technological BIM-based Aspects”, showing that the technology and experience are available but the intent to try is low, and the “Expert Contract administrators” constraint shows that companies need to hire employees with different scientific knowledge to the traditional, who are willing to implement new techniques in their work. Finally, most of the experts see that the constraint of “Risk assignment” is very difficult to overcome in the Middle East construction market but can be less difficult to overcome inside each interviewee’s specific company.

This analysis of the points indicated the following results in each viewpoint and their significance when calculating the overall highest percentage in each viewpoint: 39% of the opinions see that the constraints of implementing IPD contracts are Difficult to overcome in the Middle East Market, while 50% of the same opinions see that these constraints are Difficult to overcome inside their specific companies. This 11% difference shows that there is a strong potential to overcome the constraints affecting IPDs if companies are willing

to accept changes and new techniques inside their organizations. This analysis draws the important conclusion that the Middle East construction market is willing to accept new techniques like IPD, but the key to such change is inside the construction companies' policies and their preparedness to take positive risk.

Figure 2 represents a comparison between each of the experts' opinions in the constraints facing the implementation of IPD in the Middle Eastern market (Set 01) and their opinions of the constraints of IPD in their specific companies (Set 02). The numerical rating was (1) Very Difficult to overcome, (2) Difficult to overcome, (3) Easy to overcome and (4) Very Easy to overcome. It appears that the points presenting the experts' opinions in the Middle Eastern market are smoother, with small fluctuations, which indicates consistency and agreement in the different opinions. The experts' perspectives of the Middle Eastern Market's conditions are consistent, while the points presenting the experts' opinions in their specific companies have larger fluctuations and disturbances in their results, which reflects the big gaps in communication between these companies. The gaps in communication call for the establishing of a stronger communication channel and sharing of information through conferences, discussion meetings and technological sharing aspects, to have a comprehensive opinion about IPD implementation in the Middle East, and how to use each company's resources and knowledge to serve this goal.



**Figure 2.** Comparison Chart between the experts' opinions in the Egyptian Market vs. opinions in their specific companies.

#### 4.2. Comparison between the Egyptian and Saudi Arabian Construction Markets

A thorough comparison between the Egyptian market and the Saudi Arabian market was conducted using the statistical F-test and *t*-test. This analysis represents the factors with significant difference between the two markets, which are two of the biggest construction markets in the Middle East.

From the analysis, there is a higher percentage similarity between the two markets. However, there are factors with significant statistical difference, which are as follows:

- In Set 01 (The Respondents' View of his/ her country's Market):
  1. Resistance to change: About 89% of the experts' opinions in Egypt believe that this obstacle is difficult to overcome, while 64% in Saudi Arabia believe the same. This shows that there is a better tendency in the Saudi Arabian market to accept change if it benefits the objectives of the work.

2. Team Orientation: About 43% of the experts' opinions in Egypt believe that this obstacle is difficult to overcome, while 75% in Saudi Arabia believe the same. Opposite to the previous obstacle, this shows a better percentage in the Egyptian market to overcoming this constraint.
- In Set 02 (The Respondents' View of their Own Company):
    1. Selecting compensation and incentive structure: About 50% of the experts' opinions in Egypt believe that this obstacle is easy to overcome, while 45% in Saudi Arabia believe that it is difficult to overcome.
    2. Expert Contracts Administrators: About 60% of the experts' opinions in Egypt believes that this obstacle is Easy to overcome, while 45% in Saudi Arabia believe that it is difficult to overcome. The difference in these two points calls for a window between the two markets to share knowledge and expertise and make the two points of view become closer, so as to overcome these constraints.

#### 4.3. Comparison between the Owners and Contractors of the Middle East's Construction Market

Similar to the previous approach for comparison, the F-test and *t*-test were used to compare owners' and contractors' opinions. The results of the analysis show significant statistical difference between the two parties' points of view in the points highlighted as follows:

- In Set 01 (The Respondents' View of the Middle Eastern Market):
  1. Risk Assignment: About 56% of the owner expert opinions believe that this obstacle is very difficult to overcome, while 44% of the contractors believe that it is very easy to overcome. This large difference between the two types of opinions reflects how much more owners are afraid of the risks and their investments than are contractors. More work needs to be done to convince the owners of the large benefits of using IPD in the construction market.
  2. Relative capital investment: About 67% of the expert opinions regarding owners believe that this obstacle is difficult to overcome, while 67% of the contractors believe that it is easy to overcome. This also presents the owners' tendencies to protect their investments as much as possible.
  3. Future orientation: About 67% of the owner expert opinions believe that this obstacle is difficult to overcome, while 44% of the contractors believe that it is easy to overcome. This could be because of the dynamic nature of contractors' work, making them more capable of preparing for future projects and of implementing different project control techniques.
- In Set 02 (The Respondents' View of their Own Company):
  1. Resistance to change: About 70% of the expert opinions of the owners believe that this obstacle is difficult to overcome, while 56% of the contractors believe that it is very difficult to overcome. This again shows how the construction companies' policies can affect employees' tendency to change.
  2. Future orientation: About 78% of the owner expert opinions believe that this obstacle is difficult to overcome, while 56% of the contractors believe that it is easy to overcome. The increase in percentage in the section regarding the experts' specific companies provides stronger validation that the dynamic nature of contractors' work makes contractors more prepared for the future.
  3. Selecting compensation and incentive structure: About 67% of the owner expert opinions believe that this obstacle is difficult to overcome, while 89% of the contractors believe that it is easy to overcome. Contractors, in general, tend to be more aware of compensation assignment techniques and incentives because most of contractor companies' work is associated with calculating and achieving profit, as well as optimizing incentives.
  4. Experts' contracts administrators: About 56% of the expert opinions of the owners believe that this obstacle is very difficult to overcome, while 78% of

the contractors believe that it is easy to overcome. This could be due to the strong technical processes contractors administrators face inside contractor firms, which provides them with more knowledge and experience, making them more prepared for new techniques like IPD, and increases the trust of managers in these companies.

## 5. Comparison to Previous Research

Based on this study, the first risk category which is very difficult to overcome is the Risk assignment factor. According to other studies, developed countries, like the United States and Canada, can deal with this factor better due to formalized legal arrangements and contracts that can clearly employ risks. Also, as mentioned before, there is still a lack in literature about the implementation of this type of delivery method in the Middle East. Consequently, comparing these research results in the same region is hard, but the authors hope that this study will open the window and encourage other researchers to further analyze IPD implementation in the Middle East region further and compare different results to the proposed research.

The second risk category which is difficult to overcome is resistance to change. According to [37], overcoming resistance to change is associated with factors like leadership and education, which is currently more available in developed countries, and which can play an important role in the implementation of IPD in the Middle East. Next came Relative Capital investment and contractual legal aspects; these factors are less severe in Western countries, due to better availability. The remaining factors in this category are Future orientation, team orientation, In-Group collectivism, Implementation of strict rules, policies and regulations and Early contractor's involvement which, based on several studies, have the same severity in all the countries trying to implement the IPD approach. These factors can be solved through discussions and presenting the benefits of the IPD method to a range of bodies and different entities.

All the other remaining factors are based on collective subjective data, which means these factors can have a significant impact when implementing the IPD type of contract and should be considered and discussed through the process. These factors depend on different causes that need to be studied and controlled before the assigned construction project is initiated.

## 6. Conclusions and Summary

This research presented an overview analysis of Implementation of the Integrated Project Delivery (IPD) Contract in the Middle East Market; in particular, its constraints, approaches to overcome these constraints and its benefits. Based on previous analysis, the constraints to IPD contracts implementation in the Middle East are classified into three categories as follows: *Very Difficult to overcome*; Risk assignment, *Difficult to Overcome*; Resistance to change, Relative capital investment, contractual legal aspects, Future orientation, team orientation, In-Group collectivism, Implementation of strict rules, policies and regulations and Early contractor involvement, and *Conflicting viewpoints*; Self-protective approach, selecting compensation and incentive structure, Technological BIM-based aspects and Expert contract administrators.

The proposed approach to apply the viewpoints to the overall Middle Eastern market and the experts' specific companies was valid in distinguishing lack of communication and alignment between different systems in construction companies in the Middle East and the need to reach a suitable solution to this problem. The points with conflicting viewpoints are due to lack of communication and collaboration between the different firms in the Middle East, which can be overcome with the proposed approaches. A comparison between the Egyptian market and the Saudi Arabian market was conducted to highlight the points that need collaboration between the two countries to eliminate the constraints of implementing IPD. Then, a comparison between the contractors and the owners was performed, which reflected their different points of view and how to decrease the gaps

between them, by using different approaches that can encourage both parties to implement IPD in their companies.

Based on the conducted survey and research, scientific scholars and researchers should work on overcoming these barriers in the early stages and encourage entities and individuals to become more willing to adapt. Also, construction projects' managerial personnel should understand the positive outcomes of implementing such a project delivery method and, through this understanding, encourage and help their employees to use the method and introduce new potentials to the delivery method's capabilities.

Future studies need to be conducted to identify new methods of encouraging and coaching parties to practice IPD contracts and to clearly define their benefits. Finally, the major constraints facing the implementation of IPD in the Middle Eastern construction market can be overcome by the following guidelines: the parties involved need to adopt a tendency towards change and experiencing of new systems, and value driven selection criteria need to be followed to reach general agreement on a single contract. Different project parties need to engage in future-oriented behaviors, such as delaying illumination, planning, and investing in the future and teams need to be built with implementation of a common purpose or goal among team members. Managers also need to involve others in making and implementing decisions and individuals need to express themselves and their opinions freely without being afraid. Subcontractors need to have expertise in technologies such as Building information modeling (BIM) and different integration systems of construction projects. They also need to develop a suitable process for identifying the price of BIM tools and to solve the problematic setting of standards for sharing data among participants in the BIM process at the start of the project. Finally, there should be early involvement of the contractor in the design stage for constructability reviews.

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## References

1. Zuber, S.; Nawwi, M.; Nifa, F.A.; Bahaudin, A.Y. An overview of project delivery methods in construction industry. *Int. J. Supply Chain. Manag.* **2018**, *7*, 177–182.
2. Mesa, H.A.; Molenaar, K.R.; Alarcón, L.F. Comparative analysis between integrated project delivery and lean project delivery. *Int. J. Proj. Manag.* **2019**, *37*, 395–409. [[CrossRef](#)]
3. Ma, Z.; Zhang, D.; Li, J. A dedicated collaboration platform for Integrated Project Delivery. *Autom. Constr.* **2018**, *86*, 199–209. [[CrossRef](#)]
4. Ghavamifar, K.; Touran, A. Alternative project delivery systems: Applications and legal limits in transportation projects. *J. Constr. Eng. Manag.* **2008**, *136*, 923–930. [[CrossRef](#)]
5. Durdyev, S.; Hosseini, M.R.; Martek, I.; Ismail, S.; Arashpour, M. Barriers to the use of integrated project delivery (IPD): A quantified model for Malaysia. *Eng. Constr. Arch. Manag.* **2019**, *27*, 186–204. [[CrossRef](#)]
6. Elghaish, F.; Abrishami, S.; Hosseini, M.R.; Abu-Samra, S.; Gaterell, M. Integrated project delivery with BIM: An automated EVM-based approach. *Autom. Constr.* **2019**, *106*, 102907. [[CrossRef](#)]
7. Forbes, L.H.; Ahmed, S.M. *Modern Construction: Lean Project Delivery and Integrated Practices*; CRC Press: Boca Raton, FL, USA, 2010. [[CrossRef](#)]
8. Azhar, S.; Carlton, W.A.; Olsen, D.; Ahmad, I. Building information modeling for sustainable design and LEED® rating analysis. *Autom. Constr.* **2011**, *20*, 217–224. [[CrossRef](#)]
9. Zhang, L.; Cao, T.; Wang, Y. The mediation role of leadership styles in integrated project collaboration: An emotional intelligence perspective. *Int. J. Proj. Manag.* **2018**, *36*, 317–330. [[CrossRef](#)]

10. Lancaster, F.D.; Tobin, J. Integrated Project Delivery: Next-Generation BIM for Structural Engineering. In *Structures Congress*; ASCE: Orlando, FL, USA, 2010; p. 254.
11. AIA. *Integrated Project Delivery: A Guide*; America Institute of Architects (AIA): Washington, DC, USA, 2007.
12. Gransberg, D. *Comparative Analysis of Alliancing and Integrated Project Delivery on Complex Projects: Parallel Systems Sharing a Common Objective*; Gransberg & Associates Inc.: Norman, OK, USA, 2019.
13. Lahdenperä, P. Making sense of the multi-party contractual arrangements of project partnering, project alliancing and integrated project delivery. *Constr. Manag. Econ.* **2012**, *30*, 57–79. [[CrossRef](#)]
14. Ashcraft, H. *The IPD Framework*; Hanson Bridgett LLP: San Francisco, CA, USA, 2009.
15. Ilozor, B.D.; Kelly, D.J. Building Information Modeling and Integrated Project Delivery in the Commercial Construction Industry: A Conceptual Study. *J. Eng. Proj. Prod. Manag.* **2012**, *2*, 23–36. [[CrossRef](#)]
16. Lu, Q.; Won, J.; Cheng, J.C. A financial decision-making framework for construction projects based on 5D Building Information Modeling (BIM). *Int. J. Proj. Manag.* **2016**, *34*, 3–21. [[CrossRef](#)]
17. DeBernard, D.M. Beyond Collaboration—The Benefits of Integrated Project Delivery. AIA Soloso Website. 2008. Available online: <http://soloso.aia.org/eKnowledge/Resources/Documents/AIAP037286> (accessed on 28 October 2009).
18. Montaser, A.; Moselhi, O. Methodology for automated generation of 4D BIM. In Proceedings of the 5th International/11th Construction Specialty Conference, Vancouver, BC, Canada, 8–10 June 2015.
19. Kent, D.C.; Becerik-Gerber, B. Understanding construction industry experience and attitudes toward integrated project delivery. *J. Constr. Eng. Manag.* **2010**, *136*, 815–825. [[CrossRef](#)]
20. Bedrick, J.; Rinella, T. *A Report on Integrated Project Delivery*; American Institute of Architects: Washington, DC, USA, 2006.
21. Ashcraft, H.W. Building information modeling: A framework for collaboration. *Constr. Lawyer* **2008**, *28*, 1–14.
22. El Asmar, M.; Hanna, A.S.; Loh, W.-Y. Quantifying performance for the integrated project delivery system as compared to established delivery systems. *J. Constr. Eng. Manag.* **2013**, *139*, 04013012. [[CrossRef](#)]
23. Delerue, H.; Simon, E. National cultural values and the perceived relational risks in biotechnology alliance relationships. *Int. Bus. Rev.* **2009**, *18*, 14–25. [[CrossRef](#)]
24. Ross, J. *Introduction to Project Alliancing on Engineering and Construction Projects*; Project Control International Pty Ltd.: Sydney, Australia, 2003.
25. Sive, T. Integrated Project Delivery: Reality and Promise a Strategist’s Guide to Understanding and Marketing IPD. *Mark. Res.* **2009**, *800*, 1–30.
26. Garcia, A.J.; Mollaoglu-Korkmaz, S.; Miller, V.D. Progress Loops in Interorganizational Project Teams: An IPD Case. In *Construction Research Congress 2014: Construction in a Global Network*; ASCE: Orlando, FL, USA, 2014; pp. 2011–2020.
27. Kelly, D.; Ilozor, B. Performance outcome assessment of the integrated project delivery (IPD) method for commercial construction projects in USA. *Int. J. Constr. Manag.* **2020**. [[CrossRef](#)]
28. NASFA (A Joint Effort of the National Association of State Facilities Administrators). *Integrated Project Delivery for Public and Private Owners*. 2010. Available online: <https://www.agc.org/sites/default/files/Files/Programs%20%26%20Industry%20Relations/IPD%20for%20Public%20and%20Private%20Owners.pdf> (accessed on 17 June 2020).
29. Azhar, N.; Kang, Y.; Ahmad, I.U. Factors influencing integrated project delivery in publicly owned construction projects: An information modelling perspective. *Procedia Eng.* **2014**, *77*, 213–221. [[CrossRef](#)]
30. KPMG. *Integrated Project Delivery: Managing Risk and Making It Work for All Parties*; KPMG: 2013; pp. 2–6. Available online: <https://assets.kpmg/content/dam/kpmg/pdf/2013/10/integrated-project-delivery-whitepaper.pdf> (accessed on 17 June 2020).
31. Mitropoulos, P.; Tatum, C. Management-driven integration. *J. Manag. Eng.* **2000**, *16*, 48. [[CrossRef](#)]
32. Asmar, M.E.; Hanna, A.S. Comparative Analysis of Integrated Project Delivery (IPD) Cost and Quality Performance. In Proceedings of the 29th International Conference, Beirut, Lebanon, 17–19 October 2012.
33. Clark, M.C.; Payne, R.L. The nature and structure of workers’ trust in management. *J. Organiz. Behav.* **1997**, *18*, 205–224. [[CrossRef](#)]
34. Yee, L.S.; Yusof, A.M.; Chuing, L.S.; Chong, H.Y. An Empirical Review of Integrated Project Delivery (IPD) System. *Int. J. Innov. Manag. Technol.* **2017**, *8*, 1–8. [[CrossRef](#)]
35. Rahman, M.M.; Kumaraswamy, M.M.; Ling, F.Y.Y. Building a relational contracting culture and integration teams. *Can. J. Civ. Eng.* **2007**, *34*, 75–88. [[CrossRef](#)]
36. Seltman, H.J. *Experimental Design and Analysis*. 2013. Available online: [https://www.pmtutor.org/resources/course\\_resources/Designed\\_Experiment.pdf](https://www.pmtutor.org/resources/course_resources/Designed_Experiment.pdf) (accessed on 17 June 2020).
37. Lines, B.C.; Sullivan, K.T.; Smithwick, J.B.; Mischung, J. Overcoming resistance to change in engineering and construction: Change management factors for owner organizations. *Int. J. Proj. Manag.* **2015**, *33*, 1170–1179. [[CrossRef](#)]