




## Article

# Scrutinizing the Adoption of Integrated Project Delivery in the Kingdom of Saudi Arabia Construction Sector

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**Abstract:** The Integrated Project Delivery (IPD) approach has been acquiring applause worldwide attributable to its certified and attested outcomes in efficiently sharing threats and costs confronting the construction project. Regardless of its popularity and rationality, no substantial studies have been conducted into the Kingdom of Saudi Arabia's (KSA) construction. Hence, the novelty of this paper is probing the Saudi Arabia government tender process and procurement regulation for IPD theme deployment, reliant on a thorough literature assessment to bestow construction parties with the barriers of incorporating the IPD paradigm in KSA. The research objectives are attained via a questionnaire survey steered toward (1) pondering respondents' cognizance of IPD eventuality and deployment in the KSA's construction sector, (2) stipulating the survey's participants' preparedness for IPD implementation in KSA's construction market, (3) specifying the project phase in which the contractor should be entangled as part of the IPD method, and (4) scrutinizing the respondents' knowledge to classify the anticipated barriers to IPD from the global market in KSA. Findings unearth that the KSA construction sector still entails being more conscientious and adequate, pointing out the difficulties triggered by a dearth of awareness, apprehension, and pragmatic implementation. Further, respondents showed impartiality towards construction project stakeholders' prescience and exuberance, the existing government procurement and tendering laws, and revolutionary technological infrastructure and competency for IPD implementations in the KSA construction industry. Additionally, the contractor should be implicated and embroiled in the construction project from the early design phase. Addedly, the hurdles to deploying IPD in KSA are ranked as follows: technological, knowledge, financial, legal, and cultural barriers.

**Keywords:** Integrated Project Delivery (IPD); Kingdom of Saudi Arabia; Relational Contract; BIM; construction sector



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## 1. Introduction

Project delivery approaches remarkably impact project synchronization, collaborative effort, qualitative and quantitative progress updates, effectiveness, and the entire project's time and cost [1,2]. Principally, conventional delivery and contracting methods envision distinctive gaps in liabilities and obligations, which, in practice, contribute to incompetence whenever liability is reassigned from one repository to another [3]. Furthermore, projects conveyed conventionally incur since player-involved effectiveness and project success are distinguishable. Undoubtedly, one or more project participants may thrive despite overall project failure [4].

In the present era, an intensifying variety of construction corporates perceive that knowledge alliances can boost ambitious perks in a perceptibly competitive global market [5]. Notwithstanding, knowledge collaboration is customarily cumbersome and underperforming, employing conventional project delivery approaches. This is predominantly due to the fact that project team members from interdisciplinary organizations strive to boost individual benefits in their apprehension and proficiency by employing conventional project delivery approaches [6]. With the advancement of specialty and assimilation for construction projects, the collaborative knowledge approach presupposes incorporating project encyclopedic apprehension [7].

With this propensity, Integrated Project Delivery (IPD), arising as a novel delivery approach, is projected to alleviate conventional project delivery approaches' key challenges by incorporating the parties concerned, management systems, program management frameworks, and comprehensive apprehension into a collaborative environment from the initial phases to successful project completion [8]. To accomplish project delivery using this approach, project parties should incorporate deviated and scattered knowledge to elevate encyclopedic apprehension collaboration via extensive social bartering practices [9].

IPD was assayed to incorporate individuals, corporate structure, and practices into a chain that channeled the skills, abilities, and perspectives of all contestants to cohesively maximize project outcomes, augment owner benefit, lessen the amount of waste, and ensure competency beyond the entire project lifecycle [10]. Further, Cheng et al. [5] attested that the IPD approach may yield from 2% to 10% savings in the project's cumulative costs and may retain up to 30% when the project parties incorporate premeditated consorting.

Even so, owing to the essence of knowledge, including homogeneity, assorted variety, and board independence, knowledge alliance between project members is challenging to attain via employing the IPD methodology. This is chiefly because knowledge alliance may not deliver tangible results to project participants within the project's confined time frame. Individual coherence on knowledge benefaction is implausible to emerge whilst also partaking in knowledge transfer procedures. Addedly, social conundrums, including intrinsic unscrupulous actions and skeptical interrelations, often arise in manageable activities. This issue may put undue roadblocks in the readiness of parties to make a significant contribution and impart their knowledge to other parties, as reported by Lu et al. [11]. Considering the possible risks of such collaboration, a particular interactional governance approach for knowledge collaboration in the IPD context merits further research attention.

Within this context, the Relational Contract (RC) concept postulates the interactional governance approach. This approach adopts multiple affinitive ethics and integrity processes to sway relational exchange within provisional associations to enhance collaboration [6,12]. RC establishes a suitable conceptual underpinning for implementing the relational governance approach in the context of IPD. However, RC precepts of integrity collaboration compel IPD project participants [4,10]. Thus, Lahdenperae [13] reported that in knowledge transfer procedures, relational governance seems more efficient in avoiding managerial opportunism and skeptical associations. Even so, because of provisional associations and the furtherance of improvement, constructing trust relationships between project members is challenging in the short term. Consequently, instead of self-protective, confrontational, and untrusting associations, the relational governance approach is empowered to achieve a high level of collaboration by resolving social issues and meeting the demands of all parties.

Further along, Building Information Modelling (BIM) is budding as a breakthrough approach to handling and conveying construction projects, depicting a novel epoch in the Architecture, Engineering, and Construction (AEC) industry [14]. Basically, BIM is a paradigm that incorporates digital object-oriented knowledge to create, construct, or operate a building or infrastructure asset [15]. IPD and BIM, in tandem, are revolutionary as a prospective enhancement for project management because of their capacity to support project management rigorously with effective project results for all parties, encompassing

relevant parties, employers, contractors, construction managers, designers, and consulting firms [16].

BIM contexts and IPD approaches have been constituted to collaborate in tandem for an improved, methodical approach to handling construction projects and to boost financial gain from the primitive deployment of both approaches in a project [17,18]. Meanwhile, BIM adoption in the context of IPD projects is ameliorating construction corporations worldwide [19]. However, some barricades to BIM and IPD integration include challenges with computer platform information sharing and apprehensions about collaboratively spreading threats. According to Dalui et al. [20], IPD ploys frequently face struggles with (1) escalated forthright costs of the owner during the consent and pre-construction phases and (2) difficulty for experts and project parties to tweak this novel approach.

The uniqueness of this paper is probing the Saudi Arabia government tender process and procurement regulation for IPD theme deployment, reliant on a thorough literature assessment to bestow construction parties with the barriers of incorporating the IPD paradigm in KSA. Analogously, the bracketed study goals are to (1) conduct thoughtful scrutiny of IPD paradigm implementations in the construction industry to unearth KSA's contribution to such a research dynamism, (2) investigate the cognizance of KSA's construction sector parties about IPD conception, (3) stipulate the survey's participants' preparedness for IPD implementation in KSA's construction market, (4) specify the project phase in which the contractor should be entangled as part of the IPD method, and (5) scrutinize the respondents' knowledge to classify the anticipated barriers to IPD from the global market in KSA.

The paper's layout is outlined as (1) reviewing prior literature as an endeavor to consciously highlight the significance of the research exhibited and the knowledge gap that the research strives to satisfy, (2) showcasing the IPD approach deployment in KSA's construction sector, (3) portraying the executable empirical findings to affirm the proposed research's deployable feasibility, and (4) summarizing the research findings and conclusions.

## 2. Literature Review

It is generally speculated that deficient implications in the AEC industry are exacerbated by the secession of procedures, stakeholders, and systems in completing construction projects [21,22]. Thus, as claimed by Kelly and Ilozor [23], the procedures inspired beforehand by a separate master builder from the initiation phase to completion have become polarized and vague. As construction projects tend to be more intricate and the sector has become more specialized, the separateness of these procedures and decentralization among industry sectors have expanded [23]. Individuals and corporations enroll into a project at various stages in the AEC industry. Concerning a business-as-usual strategy, project stakeholders are only accountable for their set, whereas owners recompense the bills and maintain all threats in the project's deliverables. Countless scholars have spotlighted the requisite for the AEC sector to slant towards a further formalized, participatory, and assimilated approach to project delivery to boost productivity and quality [5,8,22–25].

Assorted relational project delivery provisions have been proposed and designed to confront the AEC sector's discretization hurdles [26,27]. In this context, IPD is an approach that is perceptibly becoming prevalent in North America and is ostensible to exchange the AEC industry's practices tremendously and project implications, as reported by [28–30]. Customarily, the owner has a solo contractual relationship with each specialized party in conventional project delivery methods, including the consultant, the contractor, etc. In contrast, and with regard to the IPD approach, the owner and all pertinent parties with primary responsibilities in the project routinely intrude into an integrated contractual arrangement, as attested by [23].

Since its inception, numerous aspects and perspectives have been employed to define and enact IPD. AIA [8] reported that, even so, six cornerstones are considered crucial to the IPD method, including (1) multi-party memorandum of understanding, (2) primitive player-involved engagement, (3) concerted threats and revenue, (4) participatory decision making

and knowledge sharing, (5) indemnification renunciation between leading players involved, and (6) mutually and cooperatively developed project intentions. These cornerstones have the practicability to create a solid team context and jointly cooperative settings. Addedly, fingers are crossed to foster information transmission and apprehension dissemination between project stakeholders [31].

In the line of participatory decision making and knowledge sharing, some researchers scrutinized the IPD's approach to promoting collaborative knowledge efforts between project participants. For instance, according to Yang et al. [32], accelerated digitalization presupposes knowledge alliance in cross-functional project parties, whereas knowledge alliance banks on progressing institutional and technological endorsement. Elghaish et al. [33] claimed that BIM contributes to mounting collaborative effort effectiveness and lessens project practice inaccuracies when integrated with IPD. Ma et al. [34] also attested that IPD involves project stakeholders with diverse backdrops, perceptions, and insights to collaborate and divvy knowledge to attain elevated collaborative efforts.

Even though numerous investigations unveil the significance of digital technologies in collaborative knowledge initiatives, regrettably, the collaborative knowledge approach, in the perspective of IPD, is a convoluted social interplay scheme banking on trust relationships. People-to-people interactions deliver the chance to recognize challenge interdependencies, forthrightly spread information, establish a shared objective, and so forth. In the IPD regard, collaborative knowledge effort depends ponderously on relational governance schemes and information technology.

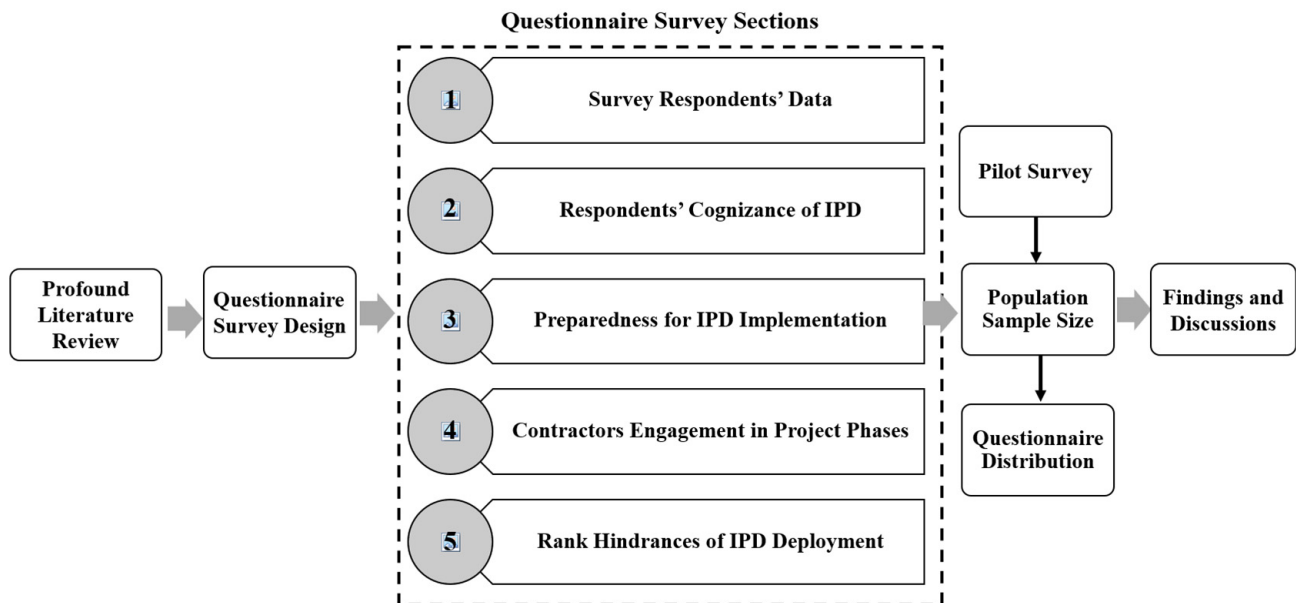
Multiple previous studies have entrenched this hypothesis. For example, Lu et al. [11] unearthed that relational governance is more proficient than conventional contract control in provisional construction projects, reconciling problems arising from social interactions, including the dearth of alliance and trust. The engendered observations platform the IPD approach's adoption to Relational Governance (RG) regarding collaborative cognitive restructuring efforts. On the other hand, the functionality of RG is not situational and is swayed by the context of a given exchange. Given the requisite for elevated collaborative efforts in the IPD perspective, it is crucial to investigate RG to yield exemplary efficiency. RG employs two pivotal domains emphasized in the RC principle to maintain and handle inter-organizational relationships over time, ensuring cohesiveness between many IPD stakeholders. Accordingly, relational social standards and trust processes are two powerful techniques of RG's functioning in the social transmission process and preserving stakeholders from encapsulated knowledge transfer challenges in IPD, including the dearth of teamwork and confined trust, as mentioned by Benítez-Ávila et al. [3].

This fact is particularly noteworthy with respect to the IPD approach, where the relational contract precepts necessitate the engagement of stakeholders for knowledge-added value. Relational norms and trust pathways, as a consequence of the inception engagement, support stakeholders in developing mutual trust and cohesiveness at the project's mobilization, thereby boosting collaborative knowledge endeavors [6]. Addedly, Pishdad-Bozorgi and Beliveau [9] and Matthews and Howell [35] stated that trust is still one of the most enormously influential precepts for social relationships in any entity. Trust nurtures rapport in the others' task-based competence to promote relational governance mechanisms and govern the IPD methodology.

This premise is predominantly attributable to the IPD's complete dependence on immensely trust-based collaborative efforts between project stakeholders. IPD stakeholders unreservedly disseminate widespread knowledge and simultaneously adhere to behavioralism, including pooled trust and respect. Once the trust scheme sways project participants, they prospectively intervene reciprocally and trustfully. As a result, the trust scheme inspires project-involved players to bestow their knowledge to project objectives and burdens.

### 3. Research Methodology

The paper's research methodology (see Figure 1) is gleaned from a structured questionnaire survey depicting a quantitative scheme. This quantitative scheme emerges by analyzing the Saudi Arabia government tender process and procurement regulation for the relevant topics, reliant on a substantial literature appraisal to educate construction parties on the hindrances of instituting IPD in KSA.



**Figure 1.** Research methodology.

#### 3.1. Questionnaire Survey Design

The questionnaire survey design is conveyed in five sections. The Section 1 amasses survey respondents' data, conceding that additional information is required. The Section 2 ponders respondents' cognizance about the deployment of IPD, BIM, and Relational Contracts in the KSA construction sector (see Table 1). Further, the Section 3 stipulates the survey's participants' preparedness for IPD implementation in KSA's construction market, as rendered in Table 1. Section 4 ascertains the project phase in which the contractor should be embroiled as an endeavor for the IPD approach, as shown in Table 1. Finally, the Section 5 scrutinizes the respondents' knowledge to rank the anticipated hindrances of IPD from the global market in KSA, including technological barriers (TB), cultural barriers (CB), knowledge barriers (KB), financial barriers (FB), and legal barriers (LB) (see Table 1).

Concerning the Sections 2 and 3, the questionnaire participants perpetrate their responses by employing a five-point Likert scale, where 1 embodies strongly disagree and never heard of it, 2 represents disagree and slightly knowledgeable, 3 depicts neutral and fairly knowledgeable, 4 portrays agree and good knowledge, and 5 implies strongly agree and highly knowledgeable. To ensure high exactitude of records accrued and to avert potential incongruence in findings, the questionnaire design reaffirms circumventing: nebulous and heavily biased queries; amorphous, odd, and perplexing wordings; double-barreled queries and neologisms; and a profoundly flawed questionnaire outline.

**Table 1.** Question points constituted in the questionnaire survey.

Questionnaire Section Number	Code	Question Point
Section 2	Q1	Have you ever heard of or acquired any prior apprehension concerning Integrated Project Delivery (IPD)?
	Q2	Have you ever heard of or acquired any prior apprehension about Building Information Modeling (BIM)
	Q3	How do you rank your experience using BIM?
	Q4	Have you ever heard of or acquired any prior apprehension about Relational Contracts?
Section 3	Q5	Do you concede that the project parties (Owner, Contractor, and consultant/designer) should be part of the same institution/company?
	Q6	Do you concede that the project stakeholders (Owner, Contractor, and consultant/designer) should function as a separate independent institution/company?
	Q7	Do you concede to permitting the contractor to contribute and engage in the project's design phase?
	Q8	Do you concede that the collaborative approach of project parties is pivotal in delivering a project?
	Q9	Do you consider that the prevailing government procurement and tendering laws impede the sufficiently high level of collaboration between the client, consultant, and contractor?
	Q10	Do you acknowledge that current government procurement and tendering laws preclude the contractor from being entangled in the project from the initiation phase?
	Q11	Do you believe that Saudi Arabia's existing technological infrastructure and proficiency can endure the implementation of BIM?
	Q12	Do you believe that the current technological prowess and insight of Saudi contractors can enable deploying BIM?
	Q13	Do you concede that the Saudi government ought to invest in groundbreaking technologies and approaches to boost the effectiveness of construction projects?
	Q14	Do you believe that project owners/clients recommend placing the project's risk on the contractor's shoulders? (i.e., the use of a lump sum contract)
	Q15	Do you concede that repeatedly venturing with the lowest bidder is the optimal route to attain?
	Q16	Do you concur that the government payment process should be enhanced, allowing for further technological advances?
Section 4	Q17	Select the project phase from the below list, in which the contractor should be embroiled as an endeavor for the IPD approach
		(a) Preliminary design phase (b) Early design phase (c) Design development phase (d) Construction phase
Section 5	Q18	Rank the foreseeable hindrances of IPD from the global market in KSA
		(a) Technological barriers (b) Cultural barriers (c) Knowledge barriers (d) Financial barriers (e) Legal barriers

### 3.2. Pilot Survey

As a constituent of the questionnaire design process, it is imperative to encompass and conduct a pilot test to identify and resolve any concerns. In this regard, a pilot survey was enacted to structure and corroborate the felicitousness of the study's primary questionnaire. In this context, the pivotal pilot survey's intention was to (1) examine the question points constituted in the questionnaire survey thoroughly, (2) appraise the time required to complete the questionnaire, (3) check the lucidity and explicitness of



the questions, (4) omit any sensitive questions, and (5) recommend the layout of the questionnaire or any particular matters.

Correspondingly, the questionnaire was electronically disseminated to a sample group of 10 experts, including four professors of civil engineering from the King Saud University, acquiring an experienced viewpoint in the construction field, four specialist engineers in tendering and procurement practices, and two project managers with over 25 years of experience in the construction sector. Participants in the pilot survey remarked that the questionnaire survey was apprehensible and straightforward to complete. However, some participants recommended rewording some questions for explicitness and partitioning the questionnaire survey into five sections. Followingly, the raised recommendations were taken on board, and the questionnaire was amended and deployed in its final portrayal.

### 3.3. Research Population Sample Size

Numerous visits were enacted to appraise respondents' willingness to contribute by leveraging their apprehension and insight and broadening the study to include further practitioners within the same scope. Face-to-face conversations with distinctive construction project parties bolstered the questionnaire survey to enhance collaboration with professionals and the accuracy of the findings.

The questionnaire survey was disseminated electronically via a Google form among experts in KSA's construction sector, as electronic survey results embolden and promisingly yield high response rates. The study's target group substantially piloted the survey sample size; the sample encompassed representatives from public, private, and semi-government construction sectors. The sample size reveals the different entities involved in the construction sector in the Kingdom of Saudi Arabia.

The survey participants' sample size is deduced using finite and infinite sample size equations [36]. Equation (1) calculates the sample size for finite survey participants based on the statistics of insightful survey participants tackling ambiguity. In Equation (1), SS symbolizes the infinite sample size of respondents, Z reflects the likelihood of obtaining a sample within a consistent set, P indicates the percentage of survey participants electing a questionnaire alternative, and C represents the confidence interval (decimal value). In juxtaposition, Godden [36] disclosed that Equation (2) computes the infinite participants' size, where the New SS embodies the finite participants' sample size and Pop is the number of participants multiplied by personnel working.

$$SS = \frac{(Z)^2 * P * (1 - P)}{(C)^2} \quad (1)$$

$$\text{New SS} = \frac{SS}{\left(1 + \frac{SS-1}{\text{Pop}}\right)} \quad (2)$$

Three parameters are entailed for consideration before identifying the proper sample size: the confidence level (Z), the confidence interval (C), and the percentage of survey participants electing a questionnaire alternative (P). Equation (1) was employed using a confidence level of 90%, and the authors can approve a 10% margin error, known as a confidence interval, in the presented research. This premise implies that the parameters adopted in Equation (1) are a confidence level of 90% and a confidence interval of 10%. Thus, the authors are 90% certain that the actual population responses re slanted towards  $\pm 10\%$  of the study's findings. Resultantly and as attested by Godden [36], the Z value is equal to 1.645 when the confidence level is 90%. Regarding the P-value, the value of "P" employed in this study was 30%, presumptively derived from earlier research [37,38]. Concerning the C value, depicting the confidence interval, the preponderance of prior studies utilizes the 10% confidence interval. The confidence interval donates how accurate and the estimate is, as reported by Ndesaulwa et al. [37], Clifton et al. [38], and Patricia et al. [39].

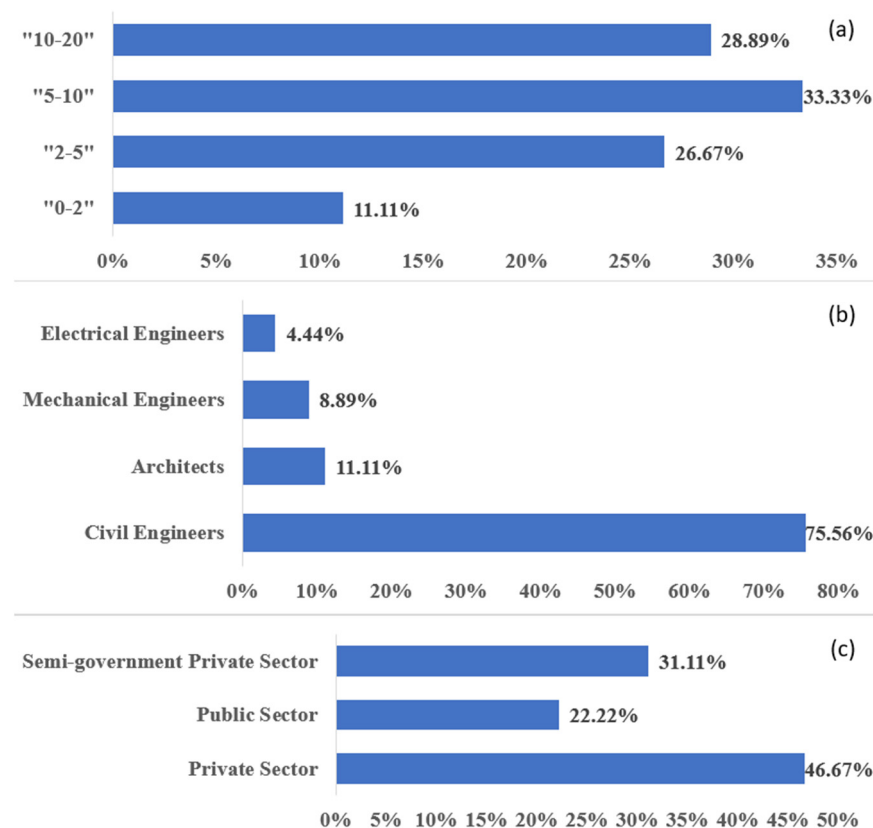
Resultantly, the finite and infinite respondents' sample sizes were calculated by employing Equations (1) and (2), as depicted below:

- Infinite population sample size =  $\frac{1.645^2 \times 0.30 \times 0.70}{0.1^2} = 57$  respondents;
- Finite population sample size =  $\frac{57}{(1 + \frac{57-1}{2000})} = 55$  respondents.

### 3.4. Questionnaire Distribution and Response Rate

The Saudi Council of Engineers was asked to lend a hand in identifying potential respondents prior to commencing the selection process. Addedly, multitudinous construction site tours were conducted to discern whether the participants were enthusiastic about sharing their apprehension and widen the study to encompass other subject matter specialists. The authors endeavored to engage and approach the participants to partake in this initiative via the study's quintessence. Attributable to values conducted from Equations (1) and (2), seventy respondents decided to partake and replete the survey questions as destined. Fifty-five participants responded, comprising nearly 78.5 percent of the predefined population, and facetly affirmed an acceptable percentage for satisfying the research objectives [36].

Figure 2 exhibits the demographic profile of respondents, divulging that the response rate of civil, architectural, mechanical, and electrical engineers was 75.56%, 11.11%, 8.89%, and 4.44%, respectively. Additionally, the response rates of respondents with 0–2, 2–5, 5–10, and 10–20 years of experience were 11.11%, 26.67%, 33.33%, and 28.89%, respectively. Finally, the percentages of respondents directly implicated in the private construction sector, the public sector, and the semi-government private sector were 46.67%, 22.22%, and 31.11%, respectively.



**Figure 2.** Demographic profile of respondents. (a) Years of experience; (b) Engineering disciplines of participants, and (c) Involvement in construction sectors.

As antecedently intimated, the questionnaire survey aimed to (1) examine respondents' cognizance about the deployment of IPD, BIM, and Relational Contracts in KSA construction sector, (2) stipulate the survey's participants' preparedness for IPD implementation in



KSA's construction market, (3) determine the project phase in which the contractor should be entangled as part of the IPD approach, and (4) explore participants' comprehension to rank the foreseeable impediment of IPD from the global market in KSA, encompassing technological, cultural, knowledge, financial, and legal barriers. The questionnaire was split into four main sections, excluding the survey respondents' data section, to perpetuate these objectives, including 18 questions for respondents to address. The elected 18 question points were compiled in light of prior research initiatives and we explored the way each point is pertinent to the KSA market. The survey queries are significantly concomitant with the versatile nature of the KSA construction industry, as outlined in Table 1.

#### 4. Results and Analysis

##### 4.1. Respondents' Cognizance of the IPD Approach

The research presented herein was constituted to communicate to appurtenant construction parties in the Kingdom of Saudi Arabia (KSA) the hindrances of instituting IPD in the KSA construction market. The study sought to examine the cognizance of IPD impediments hindering their adoption in the KSA construction sector. The findings reported here pertain to a provisional sample of massive-scale construction firms in the Kingdom of Saudi Arabia (KSA). The sampling principles were banked on the accessibility of highly competent executives and individuals. The data were amassed and examined thoroughly via an evolutionary method, in which the findings were articulated and pondered until the primary concluding outcomes were reached. According to numerous research findings, the construction markets in Saudi Arabia are gigantic as a consequence of progressing construction development initiatives. The questionnaire survey design is conveyed in five sections.

The first section amasses survey respondents' data, conceding that additional information is required. The second section ponders respondents' cognizance about the deployment of IPD, BIM, and Relational Contracts in the KSA construction sector. Moreover, the third section stipulates the survey's participants' preparedness for IPD implementation in KSA's construction market. Addedly, the fourth section ascertains the project phase in which the contractor should be embroiled as an endeavor for the IPD approach. Ultimately, the fifth section scrutinizes the respondents' knowledge to rank the anticipated hindrances of IPD from the global market in KSA. In this context, the second section ponders the respondents' insight into the Integrated Project Delivery (IPD) approach, Building Information Modeling (BIM), and Relational Contracts. In this segment, respondents were asked to rate their familiarity with these themes through research or first-hand perception.

Findings portrayed in Table 2 reveal that the IPD approach in KSA's construction sector still needs to be more precocious and satisfactorily carried out, stressing the challenges mingled with the dearth of awareness, apprehension, and pragmatic implementation. Surprisingly, nearly 31.71% and 58.54% of the respondents reported that they had never heard of nor acquired any prior apprehension regarding Building Information Modeling (BIM). Addedly, 29.27% of the respondents had never heard of nor acquired any prior apprehension about Relational Contracts. However, 31.71% attested to acquiring a fair amount of knowledge pertinent to Relational Contract adoption in the construction sector.

**Table 2.** Descriptive statistics for measuring the cognizance of the IPD approach, BIM, and Relational Contracts.

Code	Never Heard it Before (1)	Slightly Knowledgeable (2)	Fairly Knowledgeable (3)	Good Knowledge (4)	Highly Knowledgeable (5)	Mean Value	Std. Dev.	t-Test p-Value
Q1	51.22%	26.83%	12.20%	9.76%	0.00%	1.78	1.013	0.000
Q2	31.71%	19.51%	24.39%	17.07%	7.32%	2.49	1.306	0.016
Q3	58.54%	24.39%	14.63%	0.00%	2.44%	1.63	.915	0.000
Q4	29.27%	17.07%	31.71%	9.76%	12.20%	2.59	1.341	0.045

#### 4.2. Participants' Preparedness for IPD Implementation in KSA's Construction Market

Table 3 depicts a percentile spectrum classification of the respondents' viewpoints on each question from Q5 to Q16, pertinent to participants' prescience and readiness for IPD deployment in the KSA construction industry. The outcomes render the neutrality and disinterestedness of the participants' responses towards the foresight and enthusiasm of construction project stakeholders, the prevailing governmental procurement and tendering laws, and groundbreaking technological infrastructure and proficiency for IPD deployment in the KSA construction sector.

**Table 3.** Descriptive statistics for measuring the respondents' readiness for IPD implementation in KSA's construction sector.

Code	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)	Mean Value	Std. Dev.	t-Test p-Value
Q5	12.20%	29.27%	34.15%	17.07%	7.32%	2.78	1.107	0.000
Q6	0%	0%	39.02%	48.78%	12.20%	3.73	0.672	0.003
Q7	0%	9.76%	41.46%	39.02%	9.76%	3.49	0.810	0.004
Q8	0%	0%	19.51%	31.71%	48.78%	4.29	0.782	0.000
Q9	2.44%	4.88%	56.10%	34.15%	2.44%	3.29	0.716	0.000
Q10	0%	12.20%	48.78%	29.27%	9.76%	3.37	0.829	0.000
Q11	0%	2.44%	58.54%	34.15%	4.88%	3.41	0.631	0.002
Q12	0%	21.95%	41.46%	31.71%	4.88%	3.20	0.843	0.000
Q13	4.88%	12.20%	4.88%	51.22%	26.83%	3.83	1.116	0.001
Q14	0.00%	7.32%	19.51%	58.54%	14.63%	3.80	0.782	0.000
Q15	24.39%	24.39%	34.15%	14.63%	2.44%	2.46	1.098	0.002
Q16	0%	4.88%	24.39%	48.78%	21.95%	3.88	0.812	0.000

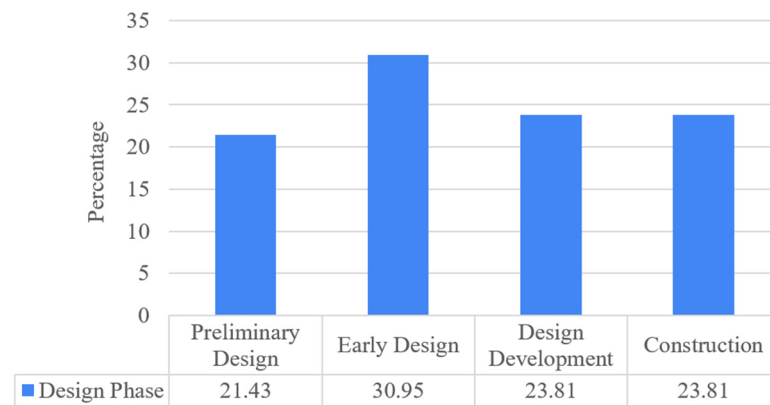
In line with the survey findings, more than 70% of survey respondents consented that government payment procedures entail more technological advancement. Even so, the survey outcomes unveiled that most participants agreed that KSA's technology environment and functionality could sustain BIM deployment while remaining neutral to the contractor's experience and abilities in BIM adoption.

Nevertheless, more than 73% of those polled concurred that project owners recommend situating the risks' entirety on the contractors' shoulders. Additionally, more than 41% of participants opposed the conception of collaborating as one entity/corporation, portraying a crucial aspect for successfully delivering the IPD approach. Addedly, 61% presumed that the project parties should maintain the conventional arrangement.

A number totaling 78% of survey respondents concurred that the Saudi government should subsidize novel methods and technologies to embellish construction project efficiency. Roughly 56.1% remained neutral, and 36.5% agreed that the current government procurement and tendering laws impede the entailed high collaboration between the client, consultant, and contractor.

#### 4.3. Contractor's Engagement in the Project Phases

Irrevocably, the questionnaire respondents were asked to discern the project phase in which they believed the contractor should be embroiled as an endeavor for the IPD approach. The choices are as follows: preliminary design, early design, design development, or construction phase. As depicted in Figure 3, findings revealed that 21.43%, 30.95%, 23.81%, and 23.81% of the survey participants elected preliminary design, early design, design development, and construction phase, respectively. These results implied that dominant respondents purported that the contractor should be embroiled in and engaged from the early design phase of the construction project.

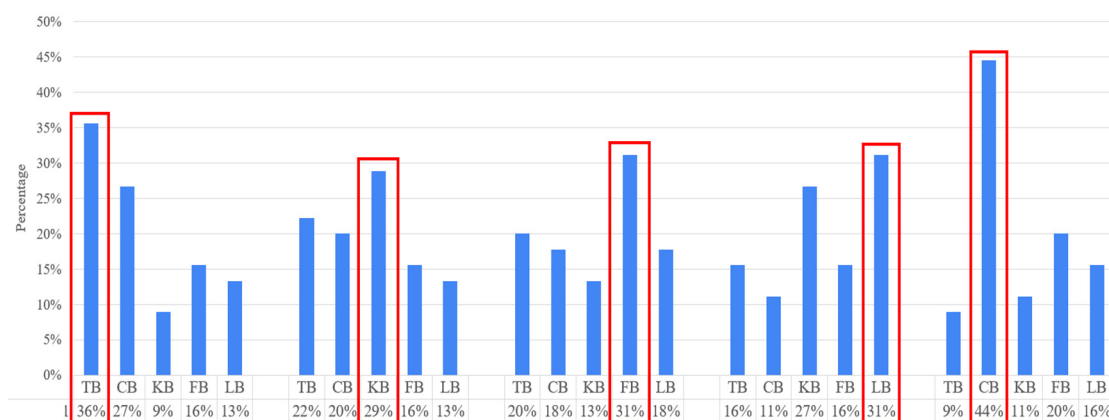


**Figure 3.** The percentage of contractor's engagement during the project phases according to respondents' feedback.

The  $t$ -test ( $p$ -value) of each questionnaire question point was adopted to discern whether or not there was a statistically substantial variance among the means of the samples analyzed. The computed  $t$ -test ( $p$ -value) is portrayed in Tables 2 and 3 as the factor defining the considered variance, with a value less than 0.05 exhibiting a statistically consequential dissimilarity among the replies retrieved.

#### 4.4. Barriers to Implementing IPD in Saudi Arabia

Finally, the fifth questionnaire section explores the respondents' insight to rank the foreseeable hindrances of IPD from the global market in KSA, including technological, cultural, knowledge, financial, and legal barriers. According to the findings presented in Figure 4, 36% of the respondents selected technological barriers as the most plausible barrier to implementing IPD in KSA. In this regard, the comprehensive deployment of the IPD approach presupposes advanced technology, such as BIM software, and the governmental payment procedure, which entails more technological advancement.



**Figure 4.** Ranking the foreseeable barriers of IPD in KSA.

Subsequently, 29% of the survey participants ranked knowledge barriers as the second barrier to hindering IPD in KSA. Furthermore, 31% of the responses ranked financial barriers as the third choice, which refuted numerous IPD research initiatives, portraying these barriers type as one of the most significant ones for implementing IPD in various countries [5,7,11]. However, these barriers may be minor and insignificant concerning Saudi Arabia's perception. Further, 31% of the survey participants ranked legal barriers as the fourth barrier to hindering IPD in KSA, followed by culture barriers in the fifth rank, as defined by 44% of the questionnaire respondents.

## 5. Discussion

This presented research endeavored, via a structured questionnaire survey, to analyze the KSA's government tender process and procurement regulation about the cognizance of IPD eventuality, potentiality, and deployment. In addition, the research investigated the preparedness for IPD implementation and appraised the hindrances of instituting IPD in KSA's construction market. With respect to preparedness for IPD implementation in KSA's construction market, findings unearthed that affirming the successful deployment of the IPD approach relies on team members' particularities, potentials, congruity, and willingness to evolve conventional behaviors. These outcomes are corroborated and verified by multiple research efforts, as attested by Zhang et al. [6], CEC [22], Ashcraft [24], IPDA [25], and Fischer et al. [29]. Regarding contractor's engagement in the project phases, findings revealed that the contractor should be embroiled in and engaged from the early design phase of the construction project, which complies with and follows the conclusions derived by Rahmani [40], Nibbelink et al. [41], AbouDargham et al. [42], and Rached et al. [43].

Concerning impediments to IPD deployment in KSA, results revealed that technological barriers are the most likely hindrance to incorporating IPD. On this basis, the thorough institution of the IPD approach presupposes advanced technology, such as BIM software, and the governmental payment procedure, which entails more technological advancement, as reported and avowed by Rosayuru et al. [17] and Elghaish et al. [33]. However, these findings do not comply with the research initiative conducted by Ebrahimi and Dowlatabadi [44], aiming to discern the perceived hurdles to implementing IPD in Canada. Their investigations unveiled that knowledge barriers, including formulating collaborative teamwork, implanting IPD conception, and timely allied decisions, are the most likely hindrance to incorporating IPD in Canada.

Moreover, in contrast to the finding that legal barriers are ranked as the fourth-ranked barriers hindering IPD in KSA according to respondents' perception, it was recognized by another research initiative as the prominent IPD features that impede IPD implementation in the Middle East [45]. Hamzeh et al. [45] concluded that the current contractual environment of Middle Eastern industry does not adequately incorporate collaboration features, contributing to successful IPD deployment. Additionally, Hamzeh et al. [45] concurred with AbouDargham et al. [42], unveiling that the legal barriers in the Lebanese construction industry are pivotal hindrances hostile to IPD deployment in Lebanon.

Addedly and speaking of the hindrances of IPD implementation, pursuant to respondents' perspectives, the cultural barriers are regarded as the fifth barrier inhibiting IPD in KSA; however, they were perceived by Rached et al. [43] as the fundamental IPD barriers and inertia hampering IPD adoption in the Middle East. Rached et al. [43] claimed that numerous firms are wedded to their respective management structures, favoring no further modifications.

Routinely, partaking in any public (government) project in Saudi Arabia requires that all contracting parties from the government agency or ministry (as an owner with the contractors and consultants) conform with the government of Saudi Arabia tenders and procurement law.

This tendering and procurement law stipulates multiple standard contracts employed for assorted tasks, including the public works contract. The public works contract is a conventional construction contract between the owner and the contractor. Traditional construction agreements address projects as discrete transactions with the primary objective of executing such projects while marginalizing relational and behavioral elements, encompassing building trust between parties.

However, concerning the executive regulations of the tenders and procurement law, Chapter Two, Article 95, Clause Seven, reported the allowance of any other type of contracting after the agreement with the Ministry of Finance. What can be conjectured from this clause is that any new contracting method can be approved after the agreement with the pertinent authority. This hypothesis implies that adopting a novel contracting process does not require enacting a new law or being deemed unlawful after the Ministry of Finance's

approval. Furthermore, the survey findings unearthed that most participants attested that the Saudi government is committed to financing innovative methods and technology to boost the efficiency of construction projects.

Apropos of supporting the government's initiatives to attain more efficiency in public projects, the Council of Ministers Resolution No. (485), issued on 16/11/1436H, states the establishment of a national program titled "National Program to Support the Management of Projects in Public Entities," which contributes to upgrading the quality of project execution in public entities through applying the optimum international practices in project management and enhancing the efficiency and quality of projects. This program intends to establish the criteria for Program Management Offices (PMOs), implement the best international practices, and develop a project standard contract template for project PMOs.

Towards implementing the IPD approach, the NPMO or "Mashroat" national program is currently in immediate communication with almost every government agency that procures or constructs a project. "Mashroat" has embarked upon considerable endeavors to harmonize public project management by authorizing a National Manual for Project Management, which enumerated a massive infrastructure for communication and performance indicators. Furthermore, the incorporation of BIM and its stipulation in the contractor prequalification and proposal evaluation is shrouded in the Mashroat national program. Technical Tender Evaluation Criteria exhibit the grading of the contractor's proposals based on specific items. One of the items is the contractor's BIM potential, which the contractor has to offer through his experience according to the Project Delivery Capability.

Given the foregoing, it is ostensible that government infrastructure and its creative paradigm should embrace and invest in progressive new approaches to ensure the delivery and deployment of the IPD approach in KSA's construction sector. It is also abundantly apparent that the adoption of the IPD approach has been inaugurated, in an immature profile, in KSA's market, denoting market endorsement of the implementation of IPD practices. Despite deploying IPD practices in its immature outlook and not yet being integrated with BIM potentials, small-scale projects have been ameliorated immensely from the IPD approach. Once the IPD's perpetual effectiveness in a small project becomes conspicuous and remarkable, the IPD in larger-scale projects can be implemented in its brimming and mature form, by employing all of the IPD's corroborating gears (multi-party contract, BIM, etc.).

It is worth noting that this paper's breadth is probing the Saudi Arabia government tender process and procurement regulation for IPD theme deployment. However, the proposed research can be refined to incur further nations and countries outside KSA to intensify its generalization. Since the IPD approach has been acquiring popularity and rationality worldwide attributable to its certified and attested outcomes in efficiently sharing threats and costs confronting the construction project, the research findings and conclusions can be outstretched and utilized by other governments outside KSA to embrace and invest in progressive new approaches and technologies and resolve barriers to ensure the delivery and deployment of the IPD approach to its full potential. Additionally, other governments outside KSA can benefit from the research conclusions to concede the substantial far-reaching cultural change entailed and the development of productive propositions to support IPD principles and concepts

## 6. Conclusions

The uniqueness of this research is that it examines the Saudi Arabian government tender process and procurement regulations for IPD paradigm deployment, relying on a thorough literature review. Synchronically and antithetically from past research initiatives, this study educates construction parties regarding the barriers of incorporating the IPD paradigm in KSA. Analogously, the bracketed study goals are to (1) conduct thoughtful scrutiny of IPD paradigm implementations in the construction industry to unearth KSA's contribution to such a research dynamism, (2) investigate the cognizance of KSA's construction sector parties about IPD conception and the relevant paradigm, (3) stipulate the

survey's participants' preparedness for IPD implementation in KSA's construction market, (4) specify the project phase in which the contractor should be entangled as part of the IPD method, and (5) scrutinize the respondents' knowledge to classify the anticipated barriers to IPD from the global market in KSA.

The research objectives are attained via a questionnaire survey steered toward (1) pondering respondents' cognizance about the deployment of IPD, BIM, and Relational Contracts in the KSA construction sector, (2) stipulating the forethought and readiness for IPD employment in KSA's construction market, and (3) scrutinizing anticipated hindrances of IPD from the global market in KSA. The respondents who replied to the questionnaire survey unveiled the following:

1. The IPD initiative in the KSA construction sector still entails being more conscientious and adequate, pointing out the difficulties triggered by a dearth of awareness, apprehension, and pragmatic implementation;
2. The impartiality and disinterestedness of contestants' answers towards the following: (a) construction project stakeholders' prescience and exuberance; (b) the existing government procurement and tendering laws; and (c) revolutionary technological infrastructure and competency for IPD implementations in the KSA construction industry;
3. Most respondents presumed that the contractor should be implicated and embroiled in the construction project from the early design phase;
4. The barriers to deploying IPD in Saudi Arabia are ranked as follows: (a) technological barriers, (b) knowledge barriers, (c) financial barriers, (d) legal barriers, and (e) cultural barriers.

Prospective research directions are required to discover novel approaches to heartening and mentoring stakeholders to adopt IPD contractual agreements and explicitly pinpoint their perks. Ultimately, the subsequent recommendations can assist in overcoming the impediments to IPD application in KSA's construction sector:

1. To attain broad consensus on a contractual arrangement, the involved parties must embrace a willingness to alter and experience new schemes and utilize value-driven entry requirements;
2. Managers must encompass others in decision making and incorporation, and individuals must be empowered to exhibit their viewpoints and thoughts;
3. Focusing on how sexual identity, cultural, and legitimate or ideological contexts shape subjective viewpoints about IPD deployment impediments;
4. Subcontractors must know about technological innovations such as BIM and various construction project integration systems;
5. Proposing proper guidelines and measures for the BIM-based IPD approach.

Appropos of recommendations for policymakers, a paragon involvement is requisite by policymakers with respect to the approach by which projects are managed in KSA. This paradigm shift should commence from the top management of construction entities, project team members, government authorities, and, pertinently, the country's governing laws that govern the construction sector, namely KSA's public tendering and procurement law. Addedly, investing in training IPD principles is recommended, and conceivably, one method could be via academic institutions through enacting capstone projects in which design and engineering students collaborate on project delivery for actual or fictitious owners using BIM-based IPD approaches.

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