Original Research

# Identifying the challenges of implementing the integrated project delivery method (IPD) in large residential projects in Iran

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## Abstract

In this paper, integrated project delivery is used as an innovative project delivery system instead of the traditional method to address productivity issues in the construction industry, risk/reward sharing and delay in architecture, engineering and construction industry. The payment of interest to the parties is subject to the completion of all project activities**.** For this purpose, by using the qualitative technique, we have identified the challenges of implementing the above method in Iran. Data were collected by interviewing 18 people, all of whom were managers and experts in construction projects and contracts. The results of the analysis of the received information indicated 31 challenges for the implementation of IPD contracts. Based on the results of the research, the challenges were divided into four categories of legal contractual principles, structural principles, behavioral principles and technological principles in applying the integrated project delivery method in large residential projects in Iran. Likewise, the scale provides information that could be used by those managers wishing to improve productivity issues in their firms. In addition, the results show that the IPD has a positive impact on construction industry.

**Keywords**- Innovative Project Delivery; Construction Industry; Construction Projects; Contractual Principles; Large residential projects

## INTRODUCTION

Residence is one of the basic needs of human society, which is found in physical form in the form of housing and as the smallest geographical unit of human life, it is considered an indicator for evaluating human development and social civilization (Oladapo, 2017). Taking into account the high speed of immigration, developments in the construction industry, greater awareness of individual rights and the requirement to meet social demands, the issue of housing and the need to access it, day by day takes on new dimensions that have led to the formation of projects. which are being built with high intensity from low-rise to high-rise and often using multi-hectare territories and multi-structures and with predetermined isolated rules (Ladigina,

2020) and have created large residential structures that It has put different dimensions of human life under the radius (Kleeman, 2023). In the construction industry, there are always many problems, the most important issues of which have been related to time, quality and the challenge of exceeding the budget (Kleeman, 2023). In managing the implementation of housing construction projects, attention must be paid to both the internal factors related to human resources and management, as well as the impact of the legal, environmental and economic environment (external factors). Both of these groups influence investment processes and lead to specific outcomes that are often decisive and even predetermine the success or failure of costly investments. What is important among them is the understanding of successful construction processes in a scientific way by industry experts (Sobieraja & Metelski, 2023). The construction industry is one of the global economic pillars that uses various resources and turns them into built infrastructure to include socio-economic growth (Naghi Zadeh, 1983). Statistics suggest that since 1964, the manufacturing industry has been the only one whose productivity has declined relatively. Also, Iran's construction industry faces many problems such as delays in project implementation, lawsuits, double costs, disputes, and stances. Projects do not perform well and often face delays in implementation and overhead costs. On the other hand, employers want more progress and improvement (AIA, 2007).

Many delays, problems in resolving claims, imposition of double costs, conflicts and losing positions, which happen in projects, are caused by the inappropriateness of the communication mechanism between the parties involved in the projects. The right way of doing the project and concluding the right contract, especially in big projects, has a decisive role in the ability and integrity of the project elements, in their successful encounter and speed of action. Therefore, in this case, there is an urgent need for a new approach to remove such problems. Integrated contracts (IPD) are one of the emerging contract systems that are currently being pursued seriously in the US (Bazazi & Jani, 2018). In this context, many organizations and institutions in the world have prepared contracts with different public and private conditions. Therefore, the use of modern executive systems, which requires accurate knowledge of all types of construction contracts, is essential for each of the activists in this field, including design engineers, supervisors, executives, contractors, and employers. On the other hand, one of the effective factors in the occurrence of implementation delays, cost increases and many disputes between the factors involved in a project has been the lack of necessary coordination between the factors involved in the project. The integrated delivery method of project items (IPD) is a new method in project delivery that increases the probability of project success by properly sharing the risk between key project factors, in addition to reducing claims. And by taking advantage of branches such as the early participation of key factors, concluding a multilateral unit contract, joint profit and loss, and joint decision-making, it involves all the key stakeholders of the project in order to make the project more successful (Nazarpour et al., 2023).

The effects of organizing work teams as one essential resource of organizations, in addition to the structure, size and effectiveness of the team, are also considered important factors (Tohidi et al., 2017). Integrated project delivery requires establishing and creating integration and collaboration. The performance of the project team requires trust between all the factors involved in the projects. IPD builds project content trust through a high-precision assignment system. Such a system creates coordination and cooperation of forces even when trust is lost because project agents will realize that the only way to reduce the impact of risks is to work together on all issues and challenges (Bozorgi & Beliveau, 2016). Integrated project delivery system has brilliant advantages and history in world projects, but it has not been implemented in Iranian projects. In this research, we are looking for practical methods for large-scale residential projects, so we try to define and analyze IPD principles accurately and practically, identify indicators and barriers to their use, and finally, the possibility of using them in large residential projects in Iran is to be examined. Project success depends on the good working relationship, respect, and trust, along with good leadership for a IPD based project system. IPD brings the skill of key project participants from developers, administrators, manufacturers, contractors and fabricators to proprietors and planners prior to tender (Dalui, Elghaish, and Brooks, 2021).

Another approach, called IPD, was first mentioned in the USA in the early 2000s. IPD and "project alliancing" are also called collaborative delivery methods. Trust, in turn, is the foundation for collaborative and cooperative work. True collaboration enables project teams to accomplish challenging tasks. Trust leads to effective communication and information sharing between the people in a project (Frantz, Hanau, and Budau, 2021). In this study, the obstacles and challenges of applying the integrated project delivery (IPD) requirements in large residential projects in Iran have been identified. Researchers have accepted innovation as a key factor to survive companies in fast changing environment (Tohidi et al. 2012). An integrated project delivery system is an innovative system for building large and complex projects. This system is a formal communication that is in progress throughout the project's design, planning, and implementation phases (Dorsey, 1997). Farahani et al (2022) state that employees are one of the effective factors in increasing productivity. In the same direction, IPD aims to work with owners, engineers, and contractors to reduce waste, reduce time, and increase production. IPD is a potential offer for the manufacture of products that have the quality, timing, buildability, availability, optimization, and scalability of these products

by involving critical specialists in the procurement cycle in the early stages of the project where they have the most significant impact on project outputs, will be produced (Azhar, Kang, and Ahmad, 2014). With the introduction of the new contract method by the American Institute of Architects (AIA) and with the participation of the Associated General Contractors of America (ACG) and many reputable architectural and construction companies in 2007 in two publications, "Definition of IPD Work" and "IPD Guide" was presented. This method considers the reason for the existence of issues such as the mismatch of people's success motivations with the project's success in current project implementation systems. For this reason, it suggests that by concluding a multilateral agreement, all factors contribute to the profit and loss of the project. IPD is a highly participatory process that integrates the skills and expertise of project teams in the early stages of the project. Experts from different departments are present in the project from the beginning to ensure that design decisions meet all the needs of the involved stockholders (Gull and Yorge, 2017). Integrated project delivery (IPD) is a project execution approach that integrates factors, system, economic structure, and habit into a process that moves the talents and insights of project agents in order to optimize project results, reduce waste and increase efficiency in all phases of the project. In this sense, IPD focuses on improving the essential project characteristics, such as time, cost and quality. For such improvement, some tools are applied such as stakeholders early involvement, open communications, collaborations, goals alignment, BIM technology as well as fair and impartial arrangements for all parties involved (Viana, Hadikusumo, Mohammad, and Kahyandi, 2021).

## DEFINITION BY THE AMERICAN INSTITUTE OF ARCHITECTS (AIA) IN THE JOURNAL OF IPD CASE STUDIES

Integrated Project Delivery (IPD) is a method of project execution that is differentiated according to the form of its contractual agreement and concluded at least between the employer, the designer, and the builder, in which risk and reward are shared among all stakeholders, and the success of the stakeholders depends on the success of the project. Reliability measures the ability of a system to provide the desired level of service against deterioration and other shocks that affect its performance (Farahani et al., 2023). IPD benefits from the high participation of project lifecycle stakeholders such as employers, designers, contractors, engineers, and suppliers to increase project reliability. Achieving success requires that the team be formed as soon as possible, that all members have free and equal access to information, and that the rewards and risks of the project are shared equally among them (ACIF, APCC, 2014). Relying on technical advances in information and software sharing over the World Wide Web, the team has become more powerful and can work with its members even over long distances to complete projects faster and cheaper (AIA, 2007). Early formation of the project team and participation of contractors in the design phase in the IPD method will complete the design before the start of the documentation phase and increase the feasibility of the project. This coordination and completion of the project in the design phase will reduce rework and time in the construction phase (Arjmandi, 1390). The purpose of this new contractual method is the integrated method of project execution, cost control, avoiding changes and rework, improving the project schedule, and enhancing the quality of the final product compared to conventional methods considering quality is the most important factor in customer satisfaction (Farahani et. al., 2021).

This method enhances the project outputs with an approach based on the effective cooperation of the teams involved in the project, defining the common profit and loss for the stakeholders and aligning the project objectives with the motivations of each stakeholder. Integrated delivery of project items is a response to the extensive collaboration required in complex 21st-century projects that affect the vast human resources in different organizations (Turner and Simister, 2001). Due to the novelty of this method, it is expected that improvements will be made with each new project. Utilizing the effective cooperation of the key partners involved in the IPD project guides the project agents in achieving the desired production rate and lower cost, less involvement and stress, and timely completion of the project compared to the traditional method (Forrest, 2008). IPD is a project implementation approach that integrates business factors and structures, systems, and individuals into one process. This participatory process uses the talents and collective insights of all the teams involved in the project to optimize the project results, increase the project value for the client, reduce waste of resources and maximize efficiency in all phases of the project (Yazdani, 2003). The IPD structure can be used in a wide range of contract forms. Integrated projects are different from other joint projects due to effective participation between team members at all stages (AIA, 2007). Benefits employer, designer, contractor, engineer, and salesperson. Achieving success with this method requires that the team be formed as soon as possible, that all members have free and equal access to information, and that the rewards and risks of the project be shared equally among them. Relying on technical advances in sharing information via the World Wide Web, the team has become more powerful, and even its members can work together over long distances to complete the design and get the project to operate faster and cheaper. Organizations and companies in various public and private sectors in policy-making and service to people and customers can take steps to grow and develop by implementing change management and rework and benefiting from the principles of buildability, and the IPD approach is a helpful tool to achieve this; Also, the achievements of constructivism

knowledge can be used for future needs, such as identifying poor structural design due to design errors or non-executive design decisions in the conceptual studies phase. The IPD approach seeks to enhance project output by aligning project objectives with the motivations of key agents involved in the project (Imam Jomeh Zadeh, 2018). Providing such conditions and goals in the project requires appropriate communication and valuable cooperation between project stakeholders. IPD highlights the need for effective cooperation and communication (Yee, Saar, and Yusof, 2017).

TABLE 1
IPD SYSTEM FEATURES

| Features | Explanation |
|---|---|
| Early presence of agents in the project | Early involvement of project team members including designer, builder and contractor from the beginning of the project to help the owner to collaborate and shape the overall goals and demands of the project from the beginning |
| Divided risk and reward | The participation of the project people jointly organizes the achievement of the benefits and goals of the project. Consequently, accepts the risk of not achieving the target cost (as well as the risk of timing and quality) |
| Multilateral contract | Individuals sign an integrated contract that clearly states the roles and responsibilities of all individuals. |
| Participatory and controlled decision making | Individuals expect to agree on a clear and specific set of participatory and controlled decision-making concepts for the project that can be tailored to the owner's goal for the project. |
| Waiver commitment among key people in the project | Contractors waive claims among themselves, except in cases such as media negligence to strengthen a sense of unity in the workplace. |
| Goals that have been jointly developed and implemented | With the help of team members, the owner clearly defines the achievable goals of the project and considers them as a milestone to be measured. Risks and rewards are defined for achieving the set of goals. |

Integrated Project Delivery (IPD) aims to address trust issues in the industry and strive to foster a positive collaboration based on mutual respect and trust. The contract and contract elements are the core of the (IPD). (IPD) in the principle of contract, co-location, lean construction and using (BIM), acts as a supporting element that helps to improve the behavior and performance of the project. The most important challenge in the IPD method is determining the real cost and achieving financial transparency in project management (Rieger Rodrigues & Munch Lindhard, 2021); which is derived from inappropriate planning in carrying out projects (Elika & Rojhani, 2022). The role of Integrated Project Delivery (IPD) is to achieve sustainability in construction projects. The use of integrated project delivery leads to the realization of sustainability goals. (IPD), has had positive results in economic, social and environmental aspects of projects; because it reduces the cost and construction time of the project and also has a positive impact on society (Adel et al., 2023).

## PRINCIPLES OF INTEGRATED PROJECT DELIVERY

The American Institute of Architects (AIA) defines the principles of IPD as follows:

*Principle 1- Mutual Respect and Trust*

In an integrated project, the value of teamwork is understood by the employer, designer, builder and other team members, and the team commits to bring the best literacy to the project.

*Principle 2- Mutual Benefit and Reward*

All participants and team members benefit from the IPD Because the IPD process requires early involvement of agents in the project, the IPD reward structure compensates for the early presence of members and is appreciated in a member incentive system.

*Principle 3- Collaborative Innovation & Decision Making*

Creativity is stimulated when the exchange of ideas and opinions occurs freely among members. In a comprehensive project, ideas and opinions are judged on their value, not on the position of spokesperson. Key decisions are evaluated by the project team and finalized unanimously.

*Principle 4- Early Involvement of key Participants*

In an integrated project, key actors enter the project as soon as possible and use their knowledge and skills to improve and expedite decisions, not based on the position and rank of spokesperson. Critical decisions are evaluated by the project team and finalized unanimously.

*Principle 5- Early Involvement of key Participants*

The project's goals are agreed upon early concerning all stakeholders. The attitude of all factors in a culture that encourages creativity is valued, and the actual engineering of values is achieved through this collaboration.

*Principle 6- Intensified Planning*

The IPD approach claims that further strengthening and effort in the planning department saves time, money and improves performance in the implementation phase.

*Principle 7- Open Communication*

IPD often relies on up-to-date technology. The technology used is identified at the outset to maximize project performance. Appropriate technology causes the exchange of information in an orderly manner and communication with advanced and appropriate technology.

*Principle 8- Appropriate Technology*

Integrated projects often rely on up-to-date technology. The technology used is identified at the outset to maximize project performance. Appropriate technology exchanges information with discipline and communication is also accelerated with advanced and appropriate technology.

*Principle 9- Organization & Leadership*

Leadership is setting a new direction or vision for a group that they follow (Tohidi & Jabbari, 2012). The leadership of different departments is assigned to the most deserving person, regardless of people's role and position in the project. Usually, the designer and builder, with the support of the entire leadership team, take on their areas of work as usual; However, specific roles are determined by project conditions (AIA, 2015). Many of the tools and participatory approaches used in the IPD method are derived from lean project implementation. Lean is a production-oriented management approach developed by Lean Manufacturing Institute (LCI) for the project. LCI is the A / E / C industry leader in the application and development of lean tools, first introduced by Toyota, which focused on reducing casualties and identifying problems before they occurred. These techniques involve major changes to the product line. For example, line workers could be allowed to stop a production line when they noticed a defect (Yabandeh, 2004).

Principles (IPD), should be used selectively depending on the purpose and actual situation of project management. (IPD) users should develop the implementation strategy to maximize project performance, depending on their priorities with regard to limited resources. A framework should be developed to guide the assessment of the type and level of implementation (IPD), to check exactly which principles (IPD) will be implemented during the project delivery phases. Also, the use of BIM, as a desirable complement to traditional construction project management methods, should be more actively popularized by policymakers (Mei et al., 2023). (IPD) and (BIM), have several common cornerstones. Obviously, both concepts support each other's implementation. The success of the implementation of each is strongly related to the other. This relationship promotes integration and collaboration with early support, key stakeholder participation, financial transparency, shared risks and rewards, joint decision-making, and multilateral cooperation as solutions (Karasu et al., 2022).

## RESEARCH METHODOLOGY

The main question of this research can be expressed as follows: how are the challenges of implementation, integrated project delivery in large residential projects in Iran investigated and determined? From the perspective of purpose, it is applied research. From the perspective of the research method, it is an analysis with a qualitative-quantitative approach (Abedi Jafari, Taslimi, and Sheikhzadeh, 2012). In this way, this research first recognizes the principles and criteria governing the project correlation method through the study of library documents. Through the study of library documents and unstructured interviews with

experts of the construction industry, the next step identifies the requirements for using the project correlation method, then uses the questionnaire tool and the ANP method to categorize and prioritize these requirements (Khaki, 2009). In this research, in order to develop an appropriate measurement scale to measure IPD in the large residential projects in Iran, three existing models were used, Delavar, Nejati and Asgharpour to obtain a new model, having nine main challenges. This nine-dimensional model is verified through 25 sub-challenges (Table VII). The IPD measurement instrument was applied using 18 interviewees. And to collect qualitative information to identify the challenges of implementing the IPD contract in Iran, interviews with experts in this field with at least 20 years of experience in civil engineering and contract management are on the agenda. In order to form the statistical population, the snowball sampling method, which is a non-random method, was selected. In this method, the researcher first selects a person with at least 20 years of experience in construction project construction for an unstructured interview (Delavar, 2005). At the end of the interview, the selected person introduced another person for the interview, and this process continued until the researcher faced duplicate data in interviews. After interviewing 18 people, all of whom were managers and experts in construction projects and contracts (Table 2), it was time to analyze the interviews. The results of the analysis of the received information indicated 31 challenges for the implementation of IPD contracts.

TABLE 2
DEMOGRAPHIC INFORMATION OF THE INTERVIEWEES

| Row | Code | Organization Type | Records (years) | Discipline | Educational stage | Organizational role |
|---|---|---|---|---|---|---|
| 1 | C1 | Employer | 12 | Civil | Masters | project advisor |
| 2 | C2 | Employer | 24 | Industry | Masters | Contract Affairs Expert |
| 3 | C3 | Employer | 28 | Civil | PhD | project manager |
| 4 | C4 | Consultant | 25 | Civil | Bachelor | project manager |
| 5 | C5 | Consultant | 29 | Civil | Masters | CEO |
| 6 | C6 | Contractor | 21 | Management | Masters | project manager |
| 7 | C7 | Contractor | 15 | Civil | Masters | project manager |
| 8 | C8 | Employer | 17 | Civil | PhD | project manager |
| 9 | C9 | Contractor | 21 | Management | Masters | project manager |
| 10 | C10 | Consultant | 25 | Management | Bachelor | project manager |
| 11 | C11 | Contractor | 20 | Civil | Masters | project manager |
| 12 | C12 | Contractor | 30 | Management | Masters | project manager |
| 13 | C13 | Contractor | 20 | Civil | Masters | project manager |
| 14 | C14 | Contractor | 21 | Industry | Masters | project manager |
| 15 | C15 | Contractor | 28 | Management | Masters | project manager |
| 16 | C16 | Consultant | 25 | Civil | Masters | CEO |
| 17 | C17 | Consultant | 15 | Management | Bachelor | project manager |
| 18 | C18 | Contractor | 20 | Civil | Masters | CEO |

Interview with experts of construction projects familiar to the IPD contract, expert in construction laws in Iran and the governing atmosphere in employers, consultants, and contractors identified the challenges in implementing an IPD contract in Iran. According to comments C1 and C6, the confidentiality of the agreements will inform all of the IPD partners of the importance of proper use of confidential information, and according to the exact selection of contract forwarding, IPD partners quickly and only in order to realize project goals. In general, an integrated implementation method is based on trust, encourages trust-based parties' cooperation, and focuses on project goals instead of personal interest. Contrary to the traditional methods of implementing the project in which hostile communications are very high, the IPD is based on participation and cooperation, and the continuity and continuity of the team are in priority (Nejati, 2014). Decisions are a way of life – it's how we get things done and move forward. Sometimes work projects require group decisions, but the vast majority of our everyday work-life and personal-life decisions are made independently (Tohidi & Jabbari, 2012).

In the shadow of these team communication and implementation of the participatory decision process, many differences internally disappear (Asgharpour, 2007). The more team cooperation in the project, the more the ability to deal with internal differences. In IPD, to avoid and prevent the expansion of disagreements and fronts of individuals against each other and focus on obtaining personal interests, a decision-maker will be defined to resolve differences in the internal form. According to the C5, the integrated delivery system is an organized management process, leading different sectors due to the role and post of individuals in the project. The roles and services in the IPD team are carried out based on the duties, and the project team guarantees that tasks, responsibilities, or privileges and services are known in the earliest possible time and clearly defined. This purpose uses a matrix that specifies the service range, tasks, powers, support roles, and leadership related to designers, builders, and employers. According to the C4, in teamwork, the team's commitment indicates the resolution of their decision

and interference in the decision-making process, and almost the most fateful process of each team is the same decision on issues and actions. The actual clarity and real intervention of the team members in decision-making is also based on the principle of trust (Asgharpour, 2003).

According to the research literature, the principles of the integrated project can be used in many contract arrangements. Integrated implementation teams are usually more members of the project triangle, and an integrated project requires comprehensive cooperation between team members from the early stages of design until the completion of the project. In IPD contracts, the transparency of the limits and contributions of individuals has been defined, and the contractual principles of IPD projects, as it was said, was the same amount of commitment of the leading partners and also the division of risk and rewards based on the results of the project. An overlook toward this approach will cover all aspects of this problem. In chapter two's study of research literature, the risk allocation mechanism defined in traditional delivery methods prevents risk sharing and rewards (Khaki, 2000). An overlook toward this approach will cover all aspects of this problem. Designers and contractors are trying to delay in cases, increasing the cost or any other case in the construction environment. Transfers responsibility to the other side. The main difference between the integrated project system with other traditional methods is in the use of multilateral memorandums is that all the critical people of the project work under a memorandum of understanding, and divide profits, loss, and risk (C2, C4 & C7).

In integrated technology projects, it should be identified at the beginning of the work to maximize the project's performance. Specifically, the IPD includes several categories of design, manufacturing, and professional production that have come together to advance the following goals: To divide the risk and reward, cooperation for employment processes and technologies reduces time, cost, and loss of resources (Kamvari, 2003). The IPD project implementation method is a workflow that uses new technologies such as BIM (Ilozer and J. Kelly, 2012). The integrated delivery system of the project addresses the commercial structure and processes that strengthen project members to cooperate with their knowledge and work earlier than usual. This early integrity allows all project members to allow all members of the project to identify your potential potentials to provide your abilities and insights into collaboration and expansion of the value of the project and apply it in the project's life cycle. According to the experts' comments in the field of research, 31 challenges identified were divided into four categories of contractual, structural, behavioral, and technological principles (Sarmad and Hejazi, 2003). Interviews are in the attached section.

TABLE 3
CHALLENGES OF STRUCTURAL PRINCIPLES

| Structural principles |
|---|
| Lack of complete and accurate feasibility |
| Problems of choosing the general contractor and subcontractor |
| The lack of trust between project elements |
| The absence of stakeholders during the project |
| Problems for choosing materials |
| Time consuming process of obtaining legal licenses |
| Problems in the risk allocation |
| Lack of necessary culture to use IPD |
| The possibility of numerous changes |
| The Increase in time and cost of the project |

TABLE 4
CHALLENGES OF CONTRACTOR-LEGAL PRINCIPLES

| Legal Contract Principles |
|---|
| The problems if fixing the claims |
| How to pay the invoices and financial statements |
| Lack of compiling standards for IPD in Iran |
| Dispute in affairs and terms of the contract |
| Challenges of some payments such as rewards and fine with payment rules in Iran |

TABLE 5

CHALLENGES OF BEHAVIORAL PRINCIPLES

| Behavioral Principles |
|---|
| Lack of clarity of the needs of the employer |
| The exclusion of decisions |
| Ambiguity in the supervision role of the employer |
| Ambiguity in the pricing process |
| Lack of knowledge of consultant and contractor from IPD |
| Uncertainty of contractor and consultant qualification |
| Ambiguity in explaining roles and responsibilities |
| Ambiguity in how different agents, are associated with each other |
| Poor teamwork |

TABLE 6
TECHNOLOGICAL CHALLENGES

| Technological Principles |
|---|
| The uncommonness of BIM in projects |
| Poor BIM application in projects that BIM is used |
| Poor and traditional design by consultant |
| Lack of knowledge of consultants from the benefits of using BIM |

TABLE 7
CATEGORIZATION OF INTERVIEWS:

| Data | Sub-Challenge | Main challenge |
|---|---|---|
| C1, C6: Confidentiality of agreements makes all IPD partners aware of the importance of correctly using confidential information.<br>C9: IPD structural principles are hazardous if there is no system for controlling information transparency.<br>C12: There is no obligation to separate information and the conditions determine.<br>C18: Information should be ranked then provided by people. | Failure to distinguish the importance of information | The lack of controlling the transparency level of information |
| C1, C6: According to the accurate selection of partners and precise contract drafting, IPD partners will easily and only exchange data to realize the project's objectives.<br>C9: IPD behavioral principles lead to misleading individuals in associations.<br>C5: Identifying the qualification of individuals is the step before the transpiration of information. Then, the association can be determined and loaded with the data. | The lack of precise definition of individuals and definition of association | |
| C18: Confidential information should be defined on a different level, and individuals should be explained about it.<br>C5: Confidential information should be provided to the relevant individual with full qualifications. | The lack of accurate definition of confidential data | |
| C2: It is advantageous because individuals can advance projects based on trust.<br>C9: It can highly lead to error and abuse. | Free access to data | |
| C15: Individuals in Iran each have their own policies and can barely be systematic.<br>C8: In the process of the project, relations are formed according to requirements | Ambiguity in how different agents, are associated with each other | |
| C7: At the beginning of the project, individuals in Iran do not complete feasibility. Errors in feasibility and primary data are numerous.<br>C8: Risks are very high due to lack of standardization for IPD in Iran.<br>C15: Due to lack of proper information, risks are not properly defined.<br>C6: The main concept of IPD is challenging, so people are very pessimistic about accepting risks based on trust and behavioral principles. | The lack of sufficient information at the beginning and the charter of the project | Not defining life cycle risks |
| C9: The IPD should take place in teams that have brilliant records among each other. This helps to understand the risks better.<br>C2: People at high taking risk levels can find a proper understanding of each other and identify risks | The lack of proper understanding of individuals | |
| Data | Sub-Challenge | Main challenge |

| | | |
|---|---|---|
| C1, C6: Confidence cooperation based on trust, and to focus on project goals instead of personal interest.<br>C9: Newcomers cannot be trusted.<br>C15: There should be enough information from the records of individuals to others. | The lack of trust between project teams | Not defining life cycle risks |
| C2: The mechanism of risk allocation defined in traditional delivery methods prevents risk and rewards sharing. | Absence of new mechanisms | The lack of proper structure of individuals |
| C4: Process structures should be defined in accordance with the principles of IPD.<br>C7: The structure of associations in Iran is personalized and does not have a clear criterion. | Definition of inefficient structures | |
| C11: There is no clear selection of the contractor for IPD and will definitely be risky.<br>C12: You can choose a limited negotiation method. | Problems of choosing the general contractor and subcontractor | |
| C11: Individuals in Iran are not looking for multilateral agreements.<br>C15: The substrate is not provided for IPD training and recognition (Still, project management knowledge and simple concepts have not been trained for managers).<br>C16: The IPD standard has many tough human and social concepts. | The lack of knowledge of contractors from the IPD | |
| There is no clear choice for the contractor for the IPD and will definitely have risks.<br>C12: One can select the limited negotiation method.<br>C13: In IPD, due to the complexity and immensity of the project, the recognition of employer, contractor, and financer is essential. Tender and negotiation methods are not proportional to the IPD principles. | Uncertainty of contractor and consultant qualification | |
| C5: Teamwork and collaborative work has been taught poorly.<br>C16: To adopt the IPD, it is possible to hold training courses before and during the execution and document the experience. But these courses do not necessarily have the right structure. | The absence of a structural and systematic substrate | |
| C3: Roles can be clearly defined, but the more important issue is to document and describe them. | The lack of a role defining system | Ambiguity in explaining roles and responsibilities |
| C5: IPD does not have a precise definition in Iran that can define the roles.<br>C6: IPD partners easily and only in order to realize the project goals to exchange information. But are this information correct? Do they help the project success? | The lack of insufficient information on the IPD | |
| C13: In IPD, due to the complexity and immensity of the project, the recognition of employer, contractor, and financer is essential. Tender and negotiation methods are not proportional to the IPD principles. | The lack of data about roles and responsibilities risk | |
| C16: Because of the lack of recognition of processes and systems, participatory delivery and integrated risks are unclear.<br>C18: People need training before accepting risks. | | |
| C9: The same amount of commitment of the key partners and the division of risk and reward based on project results as described is from the principles of the IPD projects. The employer accepts macro profit. | The lack of equal risk taking | IPD's lack of legal contractual principles |
| C9: Employer and contractor are not convinced of their profits.<br>C18: People want less risk and more profits.<br>However, IPD's insight is not so. | The lack of an equal decision-making system in contracts | IPD's lack of legal contractual principles |
| C10: The landmark process of each team is deciding on issues and actions.<br>The real clarity and real intervention of the team members in decision-making is also based on the principle of trust. Or to be recorded. | | |
| C11: Individuals in Iran have a completely negative mindset of participation. | Not satisfaction with participation. | |
| C9: When CLAIM is a source of income in Iran, IPD provides exactly the substrate for CLAIM | The lack of proper understanding of legal issues | |
| Data | Sub-Challenge | Main challenge |

| | | |
|---|---|---|
| C9: IPD requires a very strong accounting system in accordance with its own processes. IPD processes are not defined. | The lack of strong audit systems for multilateral agreements | The form of invoices' payments |
| To avoid and prevent the spread of disagreements and confronting individuals and focus on earning personal interests, a decision-maker team is defined for invoices and statements, which resolves the differences internally. | The lack of strong dispute resolution systems for multilateral agreements | |
| C4: In teamwork, the members' commitment indicates the clarity of decisions and their involvement in the process of deciding or decision making. Lack of team decision-making does not allow participation. | Lack of team decision making | Poor teamwork |
| C17: IPD is based on partnership and cooperation, and the continuity and attachment of the team are prioritized, and in the shadow of these team communications and the implementation of the participatory decision process, many differences are whipped internally. In Iran, this concept can hardly be accepted | | |
| C18: Integrated implementation teams are usually more members of the project's initial triangle, and an integrated project requires comprehensive cooperation between team members from the early stages of design until the completion of the project. | The lack of integration of the processes | |
| C2: The IPD project implementation method is a workflow that uses new technologies such as BIM. An integrated project delivery system explains the business structure and processes that empower project members to collaborate with their knowledge and apply it sooner than usual and this early integration allows all project members to better identify their potential to provide their capabilities and insights into collaborating and expanding project value. But unfortunately, we are very unfamiliar with this technology. | The unfamiliarity of managers with technology | The uncommonness of BIM in projects |

## DISCUSSION AND CONCLUSION

Due to the crucial importance of IPD in the current dynamic and competitive environment, it is critical to find a valid measure to assess IPD in construction industry firms. This measurement not only assists managers to understand which factors affect IPD but also help them to evaluate the value of their firms. Therefore, detection of weaknesses and opportunities, the managers could improve their position in the current fast changing environment. Integrated Project Delivery (IPD) as a new contractual approach in construction projects seeks to improve the output of projects by aligning project objectives and the motivations of the main parties involved in the project. This contractual model remains unknown in Iran. Meanwhile, the results of using it include increasing value for the owner, reducing waste, and maximizing efficiency in all cases of design and construction stages. In this method, the designer, builder and owner all sign a multilateral contract. According to the American Institute of Architects (AIA, 2015), IPD project collaboration is an integrated project delivery approach that integrates people, systems, business structures, and activities into a collaborative process. IPD project delivery was initially recognized as an execution system then introduced as an integrated method in some studies. Today, IPD is introduced as a project execution system with integrated project delivery as its name.

The main issue is that there is no practical model for the IPD method whose items correspond to the items of Iranian residential projects. This research looks for executive items for correlated large residential projects, so it is tried to define and analyze the principles of IPD accurately and practically, identify the indicators and barriers to its use. Finally, the possibility of applying it in large residential projects in Iran is studied. In order to achieve the predetermined goals, in the first step, the research literature was examined, which due to its infancy in Iran, no such research had been conducted. In the second step, interviews with experts were put on the agenda to identify implementation challenges. The study population consisted of seven people with at least 20 years of experience in construction projects with proficiency in contracts and their affairs. In fact, the interview continued until the researcher came across duplicate and identical data. By identifying the challenges and classifying them into four categories: legal contractual principles, structural principles, behavioral principles, and technological principles, the first goal of the research was satisfied. The need to avoid traditional management and implement new management, especially to create integration in management and establish an effective relationship, reduce tensions in the workplace and improve process communication, are among the most basic measures that can be considered for implementing integration projects contracts.

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