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Analysis of the Barriers to the Implementation of Integrated Project Delivery (IPD): A Meta-Synthesis Approach

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Abstract: The right selection of implementation system for projects in the construction industry is critical to achieve success. Integrated Project Delivery (IPD), is a comprehensive implementation system which has in recent years been seen to play an effective role in projects improved efficiency. Implementing an IPD system to resolve various problems of traditional systems is very important; however there are several barriers to its implementation. In addition, rooting and classifying the barriers is very significant in being able to resolve them. The aim of this study is the identification of barriers to IPD basically extracted from existing case studies. In this research, the meta-synthesis qualitative method is used for identifying and classifying the IPD barriers. The results are presented in a comprehensive table, and then are illustrated as a pattern by using macro concepts. This pattern is useful for presenting barriers to IPD. Identifying the barriers and resolving them are as important as identifying the benefits of IPD in creating motivation for construction industry owners. They also serve to provide the context for required predictions in implementing this approach in the construction industry.

Keywords: Integrated project delivery, barriers, project key stakeholders, meta-synthesis, construction, modification of contracts, IPD.

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1. Introduction

In the past few decades, the responsibilities and roles of the owner, architect or engineer, and contractor have been determined clearly. The owner (or client) employs the architect for preparing project design and construction documents. Then, in a tender, the contractor with a reasonable suggested price is selected for construction of a project. The contract for the mentioned project will be signed between the owner and the contractor. Advisory and monitoring roles in the contract will also be signed between the architect or engineer and the owner. Project phases in such contracts are usually proceeded with separately (Manning, 2012). In traditional systems, the key stakeholders are usually self-centered as financial success depends on different aspects of project success, and such behaviors are to the detriment of the project (Xue et al., 2010). During recent years, attempts have been made to create more harmony between construction and early planning and design stages of the project (Zhang and Li, 2014). IPD has been developing to improve project implementation and enhance success. IPD is a relatively new concept. At present, lack of proper IPD training is seen as one of the restrictions for its proper application (Parfitt et al., 2013). This system, if properly developed according to the governing rules of every country, is among the most appropriate methods for project implementation (Jayasena and Senevirathna, 2012). Classification of barriers is important, because highlighting them for decision makers is useful to resolve the barriers and effects, and to resolve these barriers for improved IPD implementation (Syariazulfa, 2016).

From the available literature, some of the potential barriers to IPD implementation have been highlighted. Researchers such as Gerber and Ghassemi, in their research project in 2011, presented a general classification of barriers to IPD implementation

(Ghassemi and Becerik-Gerber, 2011). The necessity of this study is that ,by implementing IPD in some countries such as the USA and entrance of this topic of research in some Asian and African countries, it is found that previous classifications were not comprehensive enough, and not all aspects of IPD have been considered. Such an in-depth review of the literature on obtained barriers of IPD from existing real cases has never been implemented before, while it can clarify the need for implementation of such a presented technology and IPD simply facilitates a safer construction site, as well as faster construction processes (Kahvandi et al., 2017). Therefore, in this study, barriers to IPD implementation are investigated, aiming to review numerous articles using the meta-synthesis method. The outputs of this research will provide a comprehensive view for its effective implementation. The main question of this study is as follows: what were the barriers to IPD implementation identified during recent years in different countries, and how can they be classified?

In the next section, the research background of IPD, its implementation barriers and current achievements are presented.

2. Literature Review

IPD seeks to achieve the key objectives of a project, including the lowest cost, on time project completion, and the highest quality (Michael et al., 2010). Lack of guaranteed level of productivity in traditional methods of project implementation results in failures in proper financial planning and waste of materials (Jackson, 2011). IPD is a developed system in logistics of the construction industry, in which stakeholders make innovations to achieve the project objectives faster. According to the benefits of this system, there is a possibility of its standardization at an international level (Jayasena and Senevirathna, 2012). The IPD method has contractual elements including: 1) equal rights of all stakeholders; 2) common risks and profits among all members; 3) equal responsibility of all members; 4) early presence of all members; 5) developing project objectives collectively; 6) collective decision making; and behavioral elements including: 1) mutual respect and trust among all members; 2) willingness to cooperate; 3) open and free communication (AIA Minnesota, 2012).The IPD approach can be studied from two perspectives. A philosophic perspective that is similar to traditional contract types such as Construction Management at Risk, and/or Design and Build. From a project delivery method perspective, it is composed of signing a multilateral contract among owner, designer, and other key members of the project (Sive, 2009).

In traditional methods, designers only work at the design level, and contractors are only at the construction stage. Consequently, there will be a fragmentation in construction. This fragmentation causes several problems (AIA, 2007), including duplication resulting from various changes in design that leads to extra costs more than what was estimated (Li and Taylor, 2011). Studies show that in the case of utilizing an integrated system of project implementation, the project sustainability increases significantly (Korkmaz et al., 2013). IPD provides a high level of integration which has various levels in projects, including general level, which is not stated in the contract; and advanced level, which is stated in some of the contracts. The participation level in multilateral contracts, which increases among all stakeholders necessarily, indicates comprehensive integration of systems, people, and processes (AIA, 2010). According to the existing cases, the necessity of implementing IPD systems in the construction industry is significant. Such a system is responsive for reducing the disadvantages of traditional systems, such as claims, lack of harmony in plans and implementation, false information in estimating the costs, etc. (Franklin and Tobin, 2010).

In previous years, IPD has been studied from different aspects based on the laws of the respective countries concerned. One of these aspects was barriers that were investigated. In the study by Haque in 2003, the main problems in IPD implementation were stated as poor coordination, lack of coordination during the stages of the project, and lack of progress of relevant software (Haque, 2003). Laws governing the countries have been found to make IPD implementation difficult; however, this problem would seem to have been solved to some extent in some countries in the private sector. The public sector would still seem to encounter difficulties. Some of these rules force the public sector to accept the lowest price only (Collins and Parrish, 2014). In some parts of the world, such as the Middle East, restrictions are based on factors such as lack of existence of extensive research in this field, or lack of existence of a clear vision. In addition, cultural properties, which determine conditions of work teams, or because change of habits does not occur in this region easily, new ideas faced individuals' resistance (Rached et al., 2014). In research conducted by Gerber and Ghassemi in 2011, cultural barriers were changing in terms of resistance. Organizations have been found to be unwilling to accept a new system of implementation (Ghassemi and Becerik-Gerber, 2011). Financial aspects are among cases which should be evaluated, to prevent them from leading to a barrier in system implementation. Existence of incentive programs has been found to enhance team spirit. Also, fair distribution of profit and loss during project implementation is considered in the IPD system (Rached et al., 2014). One of the important barriers to IPD implementation is in traditional contractual models where any modifications require sharing information among stakeholders. Also, liability insurance of owners, designers, and contractors in the construction industry should also be clearly developed (Sive, 2009). Forming a team is considered as an important principle of IPD (AIA, 2010). These teams include design, construction, and maintenance teams. Such selections can be done according to four types of methods, including selection based on qualifications, the best price, the best price according to competition, and the lowest price. Selection methods based on qualifications and the best price are more suitable for achieving IPD objectives. Selecting proper stakeholders in projects cannot be done through lowest price offered, but should be performed based on detailed terms identified by the stakeholders in regards to how they will interact with other stakeholders. The correct selection of team is one of the challenges of project owners (AIA, 2007).

Combining all aspects of design in different phases determines the range of activities and construction methods (Ghassemi and Becerik-Gerber, 2011). Building Information Modeling (BIM) is one of the important tools for IPD implementation (Goldberg et al., 2012). But there are some barriers in using it in IPD, including lack of

legal support from organizations, the high costs of BIM software, lack of access to all stakeholders to teach the available software, unfamiliarity of stakeholders, and lack of using BIM by subcontractors, etc. The result of cooperation of BIM and IPD will be significant in decreasing changes in design and orders. Eventually, we may observe successful completion of the project (Kiani and Khalili Ghomi, 2013). Studies have shown that high levels of readiness of information and communication technology, significantly affect IPD progress (Azhar, 2014). Using advanced tools of ICT can result in increasing the flow of data transmission (Becerik-Gerber et al., 2010). However, existing organizational barriers have negative effects on the level of this readiness (Azhar, 2014). In some parts of the world and in some projects, IPD has been implemented. In the Cathedral Hill Hospital project in San Francisco, United States, in 2007, one of the existing barriers was determining final costs in the project, and the suggested solution was the entrance of employer, providers of resources and equipment and also all of the economic parties in the project, before the beginning of construction (AIA, 2010). In late 2004, in order to construct Cardinal Glennon Children's Hospital in San Louis, United States, the barrier of lack of familiarity of employers and contractors with IPD, meant a decision to use traditional contracts for the beginning, but finally holding different seminars and education courses, convinced stakeholders to overcome problems such as inflexibility of traditional contracts and reducing construction complexities, and use of a four-sided integrated contract. A four-sided integrated contract was signed among the employer, architect, constructor, and design engineer; this contract includes even risks and benefits of some of subcontractors, such as ceilings' formatter and anti-fire system administrator. In addition, this contract includes statement of stakeholders' benefits and risks, and has insurance lack of expectations and/or restricting responsibilities. The use of IPD on the project of constructing Walter Cronkite School of Journalism, in Phoenix, United States, in 2006, was faced with a state law barrier, which forced them use design and construction contracts. However, they decided to implement IPD by maintaining the principles of design and construction contracts, behavioral principles, and some contractual principles. Therefore, the project was completed on time and without high costs (AIA Minnesota, 2012).

In this study, evaluating and classifying existing barriers for effective implementation of IPD seems significant. For that, analyzing existing barriers to IPD implementation in a systematic way is necessary to help to resolve these barriers. In the next section, the method applied is presented.

3. Research Methodology

Different methods are available to researchers to examine the qualitative findings. One of these methods is the meta-synthesis method, which is for integrating conducted studies in a special field (Noblit and Hare, 1988). According to the definition presented by Stern in 1985, the aim of the meta-synthesis method is creating sureness in outputs. While in other methods, they were looking for understanding and explaining the phenomenon (Stern and Harris, 1985). The meta-synthesis is a strong method for systematic studies, which, by statistical analysis, systematizes the results obtained from studies (Walsh and Downe, 2005). One of the general objectives of this method is theorizing and summarizing at high levels, as well as developing concepts. In this study, data obtained from the meta-synthesis method were analyzed by the Nvivo software. This software is useful in analyzing texts in qualitative studies. Through coding, one can perform information systematization easily.

According to the definition of researchers such as Sandelowski and Barroso in 2007, the meta-synthesis method has seven steps. These steps are used to identify and classify the barriers to IPD implementation in the construction industry (Sandelowski and Barroso, 2006). These steps are presented in the Fig. 1.

In the next section, the process of qualitative data analysis is stated by using seven steps of meta-synthesis method.

4. Data Analysis

4.1. Step One: Expressing the Research Question

In the meta-synthesis method, the first step is expressing the research questions. In this step, the researcher is faced with four basic questions that should be answered. The first is "What?" In this study, it is evaluating barriers to IPD implementation. The second question is "Who?" which identifies the research population. Here, reliable databases, scientific journals, university dissertations, and books are used for that. The third question is "When?" which determines time period of the research. In this study, the time period is from 2001 to 2016. Because the first definitions of the IPD approach presented in 2001, then its initial guidelines were developed in the USA in 2007. Finally, the last question is "How?". This indicates a method which is used to gather research data. In this study, literature review is applied, which is called document analysis (Noblit and Hare, 1988). Conducted studies in the field of IPD approach, are referred to. Texts of these studies form data of this research. Thus, the main question of this study is as follows:

What were the barriers to IPD implementation identified during recent years in different countries, and how can they be classified?

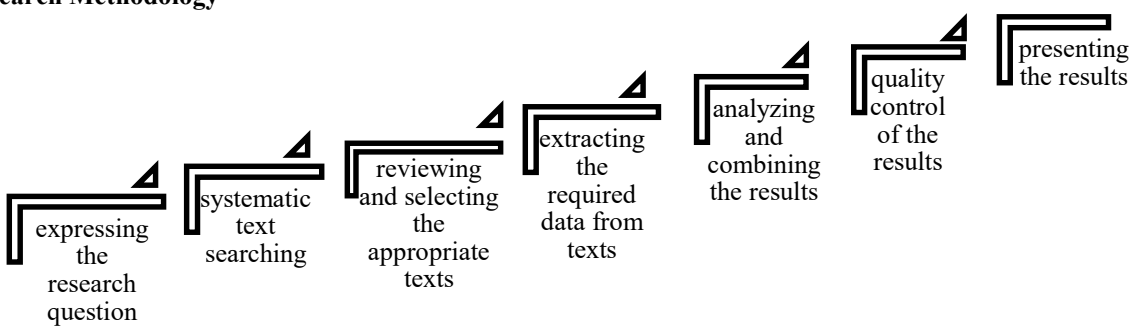

Fig. 1. Steps of meta-synthesis method

4.2. Step Two: Systematic Text Searching

In this step, by selecting a keyword related to the research question, we search texts presented in reliable scientific databases. Related keywords to the barriers to IPD implementation are presented in the Table 1.

Table 1. Keywords used in searches

Keywords
Integrated Project Delivery (IPD)
Project Management
Construction Barriers of Implementation IPD
project stakeholders participation

Reliable scientific databases reviewed in this study, are presented in the Table 2.

Table 2. Databases for searching resources

Databases
ASCE
Science Direct
AIA
SMPS Foundation
Springer
Wiley
ProQuest
Dissertation
Civilica
Taylor & Francis
IEEE

4.3. Step Three: Reviewing and Selecting the Appropriate Texts

In the third step, the meta-synthesis of texts is implemented. According to different criteria some of the texts should be deleted (Yahyapour, 2012). In this step, some criteria should be defined for accepting or rejecting texts (Weed, 2006). The criteria in this study is time of publications (publication period from 2001 to 2016) and reliability of the analyzed texts. After collecting texts by using keywords as the first step, during the next three steps, texts were reviewed to achieve reliable resources. Reviewing the title and abstract of texts is the second step. The third step is reviewing content of remaining texts from the previous step, and then, reviewing the quality of remaining articles by using the Critical Appraisal Skills Program (CASP) which is done in step four. The CASP is composed of 10 indicators to achieve desirable result. These indicators include: 1) research objectives, 2) the logic of the method, 3) research plan, 4) sampling, 5) data collection, 6) reflectivity, 7) ethical considerations, 8) data accuracy and analysis, 9) clear expression of findings, 10) research value (Campbell et al., 2003). Fig. 2 shows the process of searching and selecting articles.

As can be seen in Table 2, several scientific databases were investigated to collect articles. Most of the research articles focus on the building sector. After the initial evaluation, a number of articles lacking the above conditions that were irrelevant to the field of the construction industry were removed. By using the CASP method and selecting articles in accordance with a quality criteria, in a systematic and precise way, all of the required data were covered (Sandelowski and Barroso, 2006). Then the research team evaluated the articles from the viewpoint of studies which are focused on case studies or theory-based researches. Also, by using the meta-synthesis approach for examining the articles related to disadvantages, after conducting the initial evaluation, a number of articles which lacked the conditions mentioned in the third step and were irrelevant to the construction industry were removed (Arbabi et al., 2017).

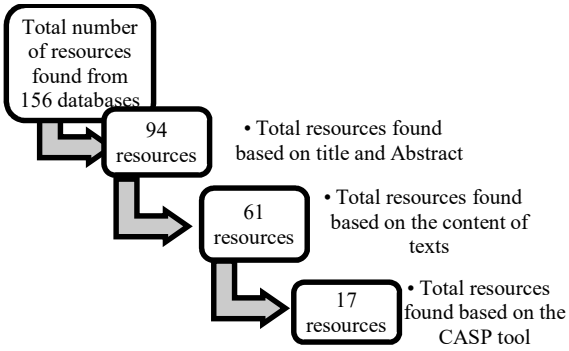

Fig. 2. The process of searching and selecting resources

In the process of searching and selecting reliable resources, 17 resources were selected, which include 16 articles and 1 thesis.

4.4. Step Four: Extracting the Required Data from Texts

In this step, 17 remaining resources from the previous step are analyzed carefully. According to the research question, various barriers mentioned by researchers in earlier studies were extracted. Collected data in this step, were coded based on their nature, and then classified. After performing the fifth step, these data were classified and presented in Appendix based on specified codes and author of the article.

4.5. Step Five: Analyzing and Combining the Results

In this step, according to Sandelowski and Barroso in 2007, an in-depth literature review is performed on what is extracted. Here, subjects are determined by the researcher. This leads to creating a classification of findings. For each subject, similar categories are defined to show its concept (Sandelowski and Barroso, 2006). As mentioned in the previous section, according to meta-synthesis method, in this step a code is assigned to each data (descriptive analysis). Then, similar codes are identified and fall in a subgroup (pattern coding). In fact, in this step, according to the proximity of data concepts, descriptive analysis is done. In the next step, based on pattern analysis, any subgroup receives a new code, too. These steps are done using the Nvivo software. Fig. 3 shows macro factors and barriers. Figures 4, 5, and 6 show the barriers, the codes and the sources processing.

4.6. Step Six: Quality Control of the Results

Quality control in the meta-synthesis method is very important. Through using CASP in the step three, the quality of articles was evaluated. Finally, quality of information was reviewed again by using coding system and classifying extracted data. Selected codes and information classifications of extracted texts from databases are consistent with desired codes in this method. Therefore, mentioned items are among reasons that guarantee high quality of presented data. In the next section, the results of this study are presented.

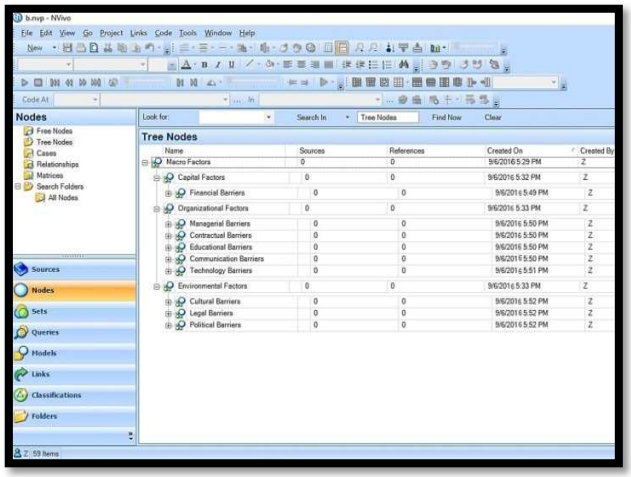

Fig. 3. Macro factors analysis using Nvivo

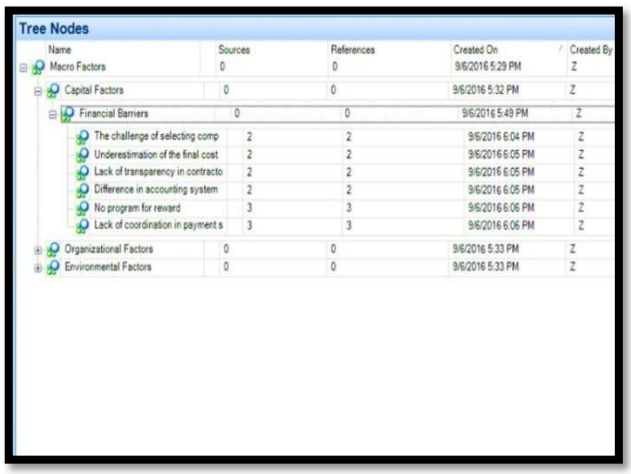

Fig. 4. Barriers analysis using Nvivo

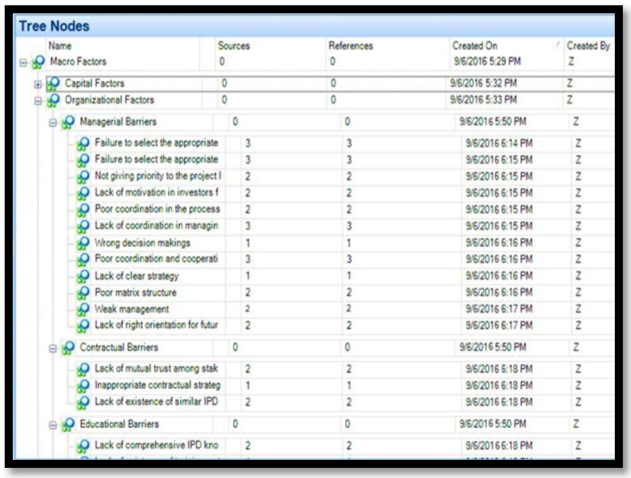

Fig. 5. Codes in Nvivo

4.7. Step Seven: Presenting the Results

At this step, what is studied and analyzed in the previous steps are presented. In the Table showed in Appendix, the results of classifying collected data are presented in three layers. All available aspects of barriers to IPD implementation are considered in this classification. Identifying and classifying macro factors are important because they are effective in creating a new database. Creating this database will be useful for planning and focus on important parts. Moreover, accordingly, we can identify powerful - positive or negative - factors better, and have a deeper look at them, and then we can take them to reduce the negative factors of the required decisions (Birnleitner, 2013). In this study, pattern coding process led us to macro factors, explained in step 5 of the research methodology which is shown in the Appendix.

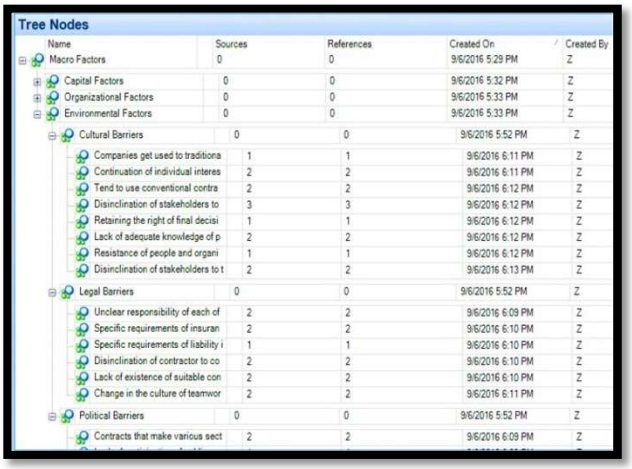

Fig. 6. Source processing

Table showed in Appendix highlights some macro factors that are the outcome of descriptive and pattern analyzes, meaning that these macro barriers are the comprehensive preventing factors for IPD implementation in infrastructure projects. This analysis process resulted in macro groups of barriers not necessarily related with each other; however, the important thing about them is that they are comprehensively covering all of the issues which prevent IPD implementation. Fig. 7 shows a brief framework of analyzes described.

What occurred during recent years after IPD implementation in different projects, suggests that barriers occurring at the beginning stages of implementation usually persist and only a few of them may be resolved. Moreover, the classification of barriers illustrated above can be named as the most comprehensive list of barriers ever researched for effective IPD implementation in the construction industry. Despite these barriers, IPD has been found to be implemented successfully in different projects. IPD has the ability to resolve a lot of problems of traditional implementation systems. In the past, barriers to IPD implementation were stated generally; however in this study, what is gained from experience of various researchers is classified, and different aspects are examined to analysis them extensively. In the next section, the findings of this research is discussed and presented.

5. Discussion

Accordingly, examining and classifying IPD barriers for knowledge integration is important, which precise and comprehensive planning should be done based on the obtained results to enhance the quality of life for users of those products. In addition, increased predictability, energy management, increased safety, increased productivity, increased product quality, maintaining the environment, etc. are among items that given high value in today's world, and each of them is very important (Syariazulfa, 2016).

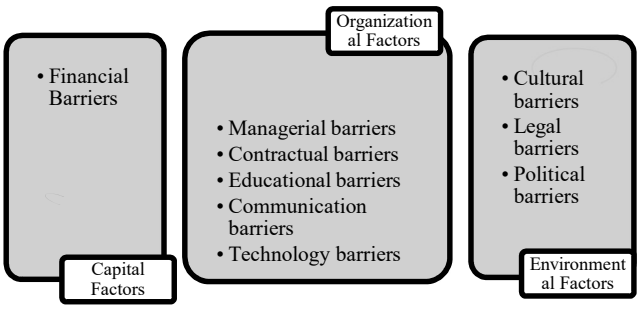

Fig. 7. Framework of macro factors and barriers to IPD implementation

In this study the macro factors can be explained in that organizations are frequently affected by a series of internal and external factors. At the same time, the organizational external factors are dynamic and variable. Therefore, every change in the external environment should be analyzed in terms of impact. The current environment of organizations is the most changeable factor and various political, social, economic and technical developments require organizations to take measures and make decisions to adapt themselves to changing environmental factors. The success of any construction project is the result of a series of factors that can be called key factors of organizational success (Hornstein, 2014).

Environmental factors have an important effect in the progress of the activities of organizations. Political, cultural and legal factors influence on competition. The environment must always be checked to determine the factors affecting the success of the organization (Korkmaz et al., 2013). An environmental survey refers to the utilization of information about situations, patterns, trends, and relationships within the organization's internal and external environment. This review will help managers determine the future of the organization. An organization must take advantage of the opportunities and minimize the threats at the time of strategy determination. A threat to an organization may be an opportunity for another organization. Therefore, a valuation of the environmental factors is necessary (Ghassemi and Becerik-Gerber, 2011).

An investor's viewpoint to the capital market depends on his ideas and opinions on risk. Research shows that many micro and macro factors are effective in the investor's viewpoint. The capital has the important effect in today's business world (Popic and Moselhi, 2014). One of the most important requirements for economic activity is providing of financial resources. Definitely identifying different ways of financing and using the appropriate financial tools will help management to make more informed decisions and obtain more resources (Duke et al., 2010).

IPD aligns the objectives of the project with the interests of key project stakeholders. In this regard, researchers are to provide different solutions for construction project owners. But along with introducing benefits and approaches for proper IPD implementation, there are various barriers facing key project stakeholders given different conditions. These barriers are different in various countries. The main reason of it is the difference in the written rules of contracts and tenders in the public and private sectors. This should be developed by legislative bodies for proper IPD implementation. Owners of this industry can demand legislative bodies, realization of developing these contracts, particularly in large construction projects, with the awareness of multiple benefits of this method. Another reason is cultural differences.

Teamwork and mutual trust in IPD are two important principles. At first it seems difficult to change what has become a habit in different cultures/societies, but it will pave the road for its change. Previous familiarity of owner with contractor and designer, and/or using previous experiences at the beginning, can be effective in resolving these barriers. By creating mutual trust and not a self-centered culture, a valuable step will be taken toward IPD implementation. A basic and documented solution in this regard, is to propose more effective IPD training. True understanding of implementation of IPD will be useful for all parties. In fact, IPD is an acceptable and advanced system in the field of mutual cooperation and reduction of changes and claims, which are the major problems of delays in projects and increases of costs (Nejati et al., 2014). Last but not least, each project is unique based on its nature, and benefits and principles of IPD should be analyzed just for performing that special project. However, comprehensiveness of IPD discussion can generalize it to other projects too (Ghassemi and Becerik-Gerber, 2011). In projects using IPD, there are various problems that are resolved by project stakeholders, and then IPD is implemented. Projects such as UHS Temecula Valley Hospital located in north of San Diego in the south of California, performed in 2014 with a budget of $151 million, and 177.508 square foot area. This project was implemented by taking advantage of IPD and TVD approaches. At first, one of the available barriers was lack of awareness of the team about IPD and TVD approaches, which was resolved through training them a few months before starting the job, in order to enhance cooperation and mutual trust among them. Finally, one of its significant achievements was an innovative design that reduced significantly change orders at runtime. Close cooperation among the contractor, designer, and employer resulted in presenting better solutions by the designer in the form of complementary designs (Do et al., 2015). In another hospital project, which was built in 2010, the barriers to IPD implementation were complexity of project implementation and the hierarchical trend of assigning contract, which were resolved by cooperation and agreement of employer for IPD implementation. Applying IPD reduced costs of this project up to 10.27%. On the other hand, applying BIM resulted in reducing project changes and complexities (Bilbo et al., 2015).

6. Conclusion

In this study, introduction, analyzing, and classification of barriers to effective IPD implementation during the past years is presented. Identified barriers are classified in different subgroups based on their nature. Then, these subgroups are placed in large categories based on a comprehensive pattern analysis. Accordingly, in order to resolve existing barriers based on large identified categories, in different regions according to governing rules, solutions can be developed to solve them. This large classification in fact shows importance of capital, organizational, and environmental factors. These factors

are presented in the form of a comprehensive framework for easier understanding. Practicing engineers can use the results of this study for comparing and evaluating different projects to resolve their similar problems. Moreover, given the numerous advantages of IPD, there is the possibility to change the trend of contracts and better IPD application in future. Therefore, determining the main and more important barriers, listed in the research, is very helpful in this regard. Considering the future of IPD progress in the construction industry, lack of attention of practicing engineers and other construction professionals to it, results in lack of development of their organizations. This study classified the barriers, so future researchers can investigate IPD implementation with a broader view to identify its enablers in different countries. Also, they can examine more case studies for implementing both concepts of IPD and BIM.

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Appendix: Identified barriers to IPD implementation

Macro Factors	Barriers	Codes	References
Capital Factors	Financial Barriers	The challenge of selecting compensation for financial losses	(Council, 2008; Rached et al., 2014)
		Underestimation of the final cost	(Rached et al., 2014; Shahhosseini, 2013)
		Lack of transparency in contractor costs	(Collins and Parrish, 2014; Nejati et al., 2014)
		Difference in accounting system of key stakeholders	(AIA Minnesota, 2012; Kent and Becerik-Gerber, 2010)
		No program for reward	(AIA, 2010; Collins and Parrish, 2014; Ghassemi and Becerik-Gerber, 2011)
		Lack of coordination in payment systems	(AIA Minnesota, 2012; Becerik-Gerber et al., 2010; Rached et al., 2014)
Organizational Factors	Managerial Barriers	Failure to select the appropriate design team	(AIA, 2010; Ghassemi and Becerik-Gerber, 2011; Michael et al., 2010)
		Failure to select the appropriate construction team	(AIA, 2010; Azhar, 2014; Collins and Parrish, 2014)
		Not giving priority to the project lifecycle	(AIA, 2010; Ghassemi and Becerik-Gerber, 2011)
		Lack of motivation in investors for using IPD	(AIA Minnesota, 2012; Collins and Parrish, 2014)
		Poor coordination in the process of projects' implementation	(Collins and Parrish, 2014; Haque, 2003)
		Lack of coordination in managing project organization	(Becerik-Gerber et al., 2010; Council, 2008; Haque, 2003)
		Wrong decision makings	(Jayasena and Senevirathna, 2012)
		Poor coordination and cooperation	(Haque, 2003; Kent and Becerik-Gerber, 2010; Kiani and Khalili Ghomi, 2013)
		Lack of clear strategy	(Haque, 2003)
		Poor matrix structure	(Haque, 2003; Kiani and Khalili Ghomi, 2013)
		Weak management	(Kent and Becerik-Gerber, 2010; Shahhosseini, 2013)
		Lack of right orientation for future	(Council, 2008; Rached et al., 2014)
	Contractual Barriers	Lack of mutual trust among stakeholders	(O'Connor, 2009; Shahhosseini, 2013)
		Inappropriate contractual strategies	(Collins and Parrish, 2014)
		Lack of existence of similar IPD contracts	(Ghassemi and Becerik-Gerber, 2011; Rached et al., 2014)
	Educational Barriers	Lack of comprehensive IPD knowledge in project management,	(Kent and Becerik-Gerber, 2010; Kiani and Khalili Ghomi, 2013)
		Lack of existence of training materials in some countries	(Kiani and Khalili Ghomi, 2013)
		Lack of familiarity of employers and contractors with IPD.	(Shahhosseini, 2013)
	Communicat ion Barriers	Poor transmission through all stages of the project	(Haque, 2003)
		Lack of existence of right people in a place through all stages of the project	(Nejati et al., 2014)
	Technology Barriers	Lack of integrated interoperability because of lack of necessary technology	(Ghassemi and Becerik-Gerber, 2011; Kent and Becerik-Gerber, 2010; Rached et al., 2014)
		Lack of using BIM as an appropriate tool for IPD implementation	(Goldberg et al., 2012; Haque, 2003)
		Changes in the original design in the construction stage	(Ghassemi and Becerik-Gerber, 2011; Nejati et al., 2014)
		Lack of enough knowledge for design and construction among advisors	(Haque, 2003; Nejati et al., 2014)

Macro Factors	Barriers	Codes	References
Environmental Factors	Cultural Barriers	Companies get used to traditional systems	(Council, 2008)
		Continuation of individual interests	(Rached et al., 2014; Shahhosseini, 2013)
		Tend to use conventional contractual methods,	(Kiani and Khalili Ghomi, 2013; Nejati et al., 2014)
		Disinclination of stakeholders to participate in a project with common interests,	(Council, 2008; Ghassemi and Becerik-Gerber, 2011; Nejati et al., 2014)
		Retaining the right of final decision for the owner	(Nejati et al., 2014)
		Lack of adequate knowledge of people to solve the problems	(Ghassemi and Becerik-Gerber, 2011; Rached et al., 2014)
		Resistance of people and organizations to new ideas	(Rached et al., 2014)
		Disinclination of stakeholders to take risk	(Cohen, 2010; Sive, 2009)
	Legal Barriers	Unclear responsibility of each of parties	(Collins and Parrish, 2014; Sive, 2009)
		Specific requirements of insurance to the entire project	(Ghassemi and Becerik-Gerber, 2011; Rached et al., 2014)
		Specific requirements of liability insurance	(Ghassemi and Becerik-Gerber, 2011)
		Disinclination of contractor to cooperate for design	(Ghassemi and Becerik-Gerber, 2011; Nejati et al., 2014)
		Lack of existence of suitable conditions for IPD implementation in the public Construction sector	(Collins and Parrish, 2014; Kiani and Khalili Ghomi, 2013)
	Political Barriers	Change in the culture of teamwork	(Ghassemi and Becerik-Gerber, 2011; Rached et al., 2014)
		Contracts that make various sections to follow it	(Cohen, 2010; Council, 2008)