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A framework for implementing integrated project delivery in architecture design firms in Egypt

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Abstract

Purpose – This paper aims to develop a framework for implementing the integrated project delivery (IPD) approach during the design process in architecture design firms (ADFs) in Egypt.

Design/methodology/approach – A research methodology consists of literature review, case studies and survey questionnaire was designed to achieve the abovementioned aim. First, literature review was used to identify and categorise the challenges of implementing IPD during the design process. Second, four case studies were analysed to investigate the values delivered to the client or missed due to the use of IPD or traditional procurement approaches, respectively. Finally, a survey questionnaire was carried out with a representative sample of ADFs in Egypt to investigate their perception towards the challenges of IPD implementation in Egypt. Based on the results of the above, the research developed a framework to facilitate the implementation of IPD in ADFs in Egypt.

Findings – Through literature review, the research identified 30 challenges that hamper the implementation of IPD in ADFs. These challenges were categorised due to their nature into five groups, namely, integration, cooperation, commitment and trust challenges, knowledge, experience skills and decision-making challenges, cultural challenges, legal and contractual challenges and technical and financial challenges. Results of data analysis showed that "poor communication and spirit of collaboration between project stakeholders" was ranked the highest influential challenge as IPD is based on collaboration and trust between project participants. In addition, "lack of training and motivation in investing for using IPD" was ranked the lowest influential challenge due to the poor attention paid to training in the construction industry. Moreover, despite the benefits of IPD implementations in many countries worldwide, it is not implemented in the Egyptian context. This necessitated taking action towards developing a framework to facilitate IPD implementation in ADFs in Egypt.

Research limitations/implications – The research focussed on ADFs in Egypt.

Practical implications – Adopting the proposed framework developed through this research will help implementing IPD during the design process in ADFs.

Originality/value – The research identified, categorised and analysed the challenges that obstruct the implementation of IPD in ADFs. The research tackled a topic that received scant attention in construction literature in the Middle East generally and Egypt in particular. In addition, this paper presented a framework to facilitate the implementation of IPD during the design process, which represents a synthesis that is novel and creative in thought and adds value to the knowledge in a manner that has not previously occurred.

Keywords Client value, Traditional procurement, Integrated project delivery, Challenges, Architecture design firms, Egypt, Architecture, Built environment research, Management, Client value, Traditional procurement, Integrated project delivery

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1. Introduction

The increasing recognition that clients are the core of the construction industry and one of the driving forces for improvement and innovation highlighted the need to achieve their satisfaction (Latham, 1994; Egan, 1998; Torbica and Stroh, 2001). Clients are most likely to be satisfied when they are provided with quality products and services that deliver the best value for money. This could be achieved through proper understanding of their requirements, fulfilling their needs, integrating them in the design decision-making process and delivering the project within the specified time and most cost-effective manner (Ahmed and Kangari, 1995; Hudson, 1999). Clients are the most valuable asset of any organisation wishes to remain in market and compete for the future. Accordingly, they have to be treated as the organisation's top priority (Goetsch and Davis, 2000; Othman, 2007). The traditional procurement approaches that are commonly used in construction projects play a significant role in separating design from construction. Such separation prevents construction professionals from providing the design team with constructive feedback and comments that enhance the project design and delivered values. In addition, the traditional procurement approaches are great sources of waste, disputes and time consumption. Towards overcoming these limitations, a number of approaches, tools and techniques have been developed over the years such as total quality management, robust design, reliability analysis, failure mode and effect analysis, function analysis, Tagushi methods and quality function deployment (Kamara *et al.*, 1999). Regardless the contribution of these approaches, the issue of providing poor value to the client still exists. Integrated Project Delivery (IPD) is one of the recent and quickly implemented approaches which incorporate people, systems, business structures and actions into a process that colludes the talents and visions of all project participants to increase client's delivered value, reduce waste, enhance collaboration, and increase the efficiency throughout the project lifecycle (Eastman *et al.*, 2008). Despite the obvious benefits of adopting the IPD approach in the USA and many countries worldwide, its implementation during the design process in the Middle East and Egypt is accompanied with a number of challenges which limit its adoption in Architecture Design Firms (ADFs) (Rached *et al.*, 2014). Accordingly, this paper aims to discuss the challenges of implementing IPD during the architecture design process and to develop a framework to facilitate its integration in ADFs in Egypt. To achieve this aim, a research methodology consists of literature review, case studies and survey questionnaire was developed to:

- build a comprehensive background about the research topic through reviewing the nature of the construction industry in Egypt, value in construction, traditional procurement approaches and IPD as well as challenges of implementing IPD in ADFs;
- investigate the values delivered to the client or missed due to the implementation of IPD or traditional procurement approaches, respectively;
- examine the perception of ADFs towards the challenges of IPD implementation in ADFs; and
- develop a framework to facilitate the implementation of IPD during the design process in ADFs in Egypt.

2. Literature review

2.1 The nature of the construction industry in Egypt

Construction is one of the biggest industries worldwide. It plays a significant role towards achieving the social and economic development plans nationally and internationally. It is

one of the most active sectors of the Egyptian economy accounting for about 5% of GDP and uses about 11% of the total population (Essam and Ehab, 2015). Egypt is one of the leading manufacturers of reinforced steel and cement in the Middle East by 1.7 billion loans of steel and 56 million tons of cement, respectively. As part of the National Strategic Development Strategy, the Egyptian Government is planning to establish 44 new cities in all Egyptian Governorates until 2052 with an annual budget of US$850m. Moreover, the government has planned to establish an Airport city, renewable energy projects, 3 new power stations, 10 new solar stations, national housing projects and the Suez Canal corridor project in several governorates with investment of US$70bn. Despite the boom of construction in Egypt, the industry is blamed for its negative impact on the environment. In 2012, 89.03 million tons of solid waste was generated in Egypt in which 4 million tons were construction and demolition waste. This problem could be attributed to traditional procurement approaches adopted in the Egyptian construction industry and the inability to handle the different challenges regarding waste generation and pollution of the environment. This called for the construction industry to be innovative, smart and consider sustainable solutions. Moreover, the use of public–private partnerships is encouraged to finance public sector projects and share experience of project participants (Daoud *et al.*, 2018).

2.2 Clients and client satisfaction in construction

Clients represent the cornerstone for the existence and growth of the construction industry (Boyd and Chinyio, 2006). They are arguably the most important participants as they are the originators of the construction process (Gwaya *et al.*, 2014) and can be best considered as one of the driving force for development (Kamara *et al.*, 2000). In addition, they take the initiative and enter into contracts with other professionals to have a project designed and constructed to fulfill certain needs, and, in turn, they pay for the construction. The business in construction is about delivering projects that achieve clients' satisfaction through fulfilling their needs, meeting their expectations and providing best value for money. However, one major concern within the global construction industry is the general increase in client dissatisfaction (CIDB, 2011). It is crucial to understand clients' values in construction projects and strive to achieve them and limit frustration amongst project participants (Thyssen *et al.*, 2008). Othman *et al.* (2004) stated that clients do not merely measure project success by meeting the anticipated time, cost and performance goals, but also by satisfying emergent requirements which were not initially identified during the briefing stage and by integrating them in the design decision-making process. The engagement of clients and relevant stakeholders in the early stages of the project, contributes towards defining a clear project brief that enhances the values delivered to the client (Ballard, 2008). Accordingly, the construction industry has to make every effort to improve client satisfaction through continual improvement and flexibility in responding to clients' requirements, meeting end-users' needs, coping with regulations changes, exploiting business opportunities, adapting to technology improvement and providing best value for money (Othman *et al.*, 2004). In addition, ADFs and construction organisations have to examine their quality systems on a regular basis to ensure their responses to ever-changing customer requirements and expectations. This involves investment in customer relationship management with the aim of regularly and systematically mapping out individual customer preferences and creating new opportunities based on the knowledge gathered. Moreover, a competitive selling price is necessary in the modern workplace, but should not be achieved by sacrificing quality or service (Goetsch and Davis, 2000). The after completion service of buildings represents one of the most important ways of improving client satisfaction (Marsh, 1999).

2.3 The concept of value in construction

Value is defined as a measure expressed in currency, effort, exchange or on a comparative scale, which reflects the desire to obtain or retain an item, service or idea (Kelly and Male, 1993). The Institute of Civil Engineers referred that value can be considered as the ration of function achieved to its life cycle cost. Value = function/cost (life cycle cost) (ICE, 1996). Dell'Isola (1997) stated that three basic elements that provide a measure of value to the user are function, quality and cost. Maximising the relationship of these three elements is necessary to satisfy the client. Value could be enhanced by improving either function or quality or both or reducing cost. A decision that improves quality but increases cost to a point where the product is no longer marketable is as unacceptable as one that reduces cost at the expense of the required quality or performance. In addition, if added cost does not improve quality or enhance the ability to perform the necessary functions, then value is decreased. A balance between value elements is required to achieve best value for money. From this relationship, value has been defined as the most cost-effective way to accomplish a function that will meet the user's needs, desires and expectations (ECOMAN, 2001). Where, Othman (2007) integrated the elements of sustainability to define sustainable values as the optimum achievement of the required functions that meet the clients' and users' needs, desires and expectations in a way that protects the environment, enhances society and prospers the economy.

2.3.1 Types of value in construction projects. Thiry (1997) and PROMIS (2003) stated that there are five different types of value which vary in importance according to the client's objectives.

(1) Firstly, use value (need) which is the amount of current resources expanded to ensure that the delivered product performs its intended function.

(2) Secondly, esteem value (want) which represents the amount of current resources a user is willing to expand for functions attributable to pleasing rather than performing.

(3) Thirdly, exchange value (worth) which is the amount of current resources for which a product can be traded for something else.

(4) Fourthly, cost value that could be described as the amount of current resources expanded to achieve a function measured in monetary terms.

(5) Finally, function value (design value) which is the relationship between design function worth and function cost.

On another perspective, Boyd and Chinyio (2006) and Aliakbarlou *et al.* (2017) stated that there are two types of client value, namely, terminal value and instrumental value. Terminal value is the factors that are related to cost, time and quality where the instrumental value is related to the delivery of the team's participation, relationships and coordination. Delivering the value to the client is accomplished when the project terminal values are correlated with the instrumental values (Meng, 2012). However, terminal values are counted as the goals and objectives that are to be accomplished by clients and instrumental values are counted as a means to an end (Boyd and Chinyio, 2006).

2.4 Building procurement

Chambers English Dictionary (2014) defines procurement as the process of obtaining goods and services. When the term "Procurement" is used in the construction context, it could be described as obtaining the whole spectrum of goods, materials, plant and services to design, build and commission a building that delivers the best value for the client over its life cycle.

Traditionally, the criteria for selecting the procurement approach was based on the cheapest or lowest priced bid; however, recently the emphasis has changed from cheapest price to best value (Cartlidge, 2013). When a client wishes to construct a new building, renovate or extend an existing building he/she will normally needs the services of many construction-related organisations to achieve the desired end product. There are two main methods of procurement in the construction industry, namely, traditional and non-traditional procurement methods (Adenuga, 2013).

2.4.1 Traditional methods. The traditional structure for project procurement is a sequential method as the client takes his/her scheme to an advanced stage with his professional team before appointing a contractor. The architect is employed to advise the client, design the project and ensure that the work is kept within the cost limit and complies with the quality standards required. A quantity surveyor can be engaged to give guidance on design costs and budgets, prepare bill of quantities, check tenders, prepare interim valuations and advise on the value of variations. Consultant structural and services engineers are employed to design the specialist parts of the project (Brook, 2004). The traditional procurement approach creates a separation between the design team and construction professionals involved in the project. Ignorance and lack of appreciation of other people's roles would reduce the ability to cooperate and communicate effectively as well as prevent the provision of valuable comments and creative ideas, which, in turn, will reduce the value delivered to the client (Dulaimi and Dalziel, 1994). The outcome of the traditional procurement practices caused the construction industry to be inefficient, fragmented and ineffective (Latham, 1994; Egan, 1998). Types of contracts that are usually used under the traditional procurement include fixed price contract, unit price contract, cost reimbursement contract and cost target contract (Hinze, 2013).

2.4.2 Non-traditional methods. Since the early 1960s, various non-traditional ways of carrying out construction projects have been devised with varying degrees of success. Non-traditional methods focussed on reducing the time traditionally consumed in producing a design and preparing tender documentation, thus enabling construction work to begin sooner. Another important factor has been bringing the contractor in at an early stage in the design process. Under the traditional procedures, the contractor rarely played any part until the tender stage was reached and after virtual completion of the design. The increasing complexity of projects led to realise that it was in the interests of clients and architects to use the vast amount of knowledge and practical experience of contractors early in the design process, and that this would make a valuable contribution to a successful outcome. Moreover, non-traditional methods helped reducing the duration for borrowing money to finance projects, fulfilling emerging clients' needs for better value for money and an earlier return on their investment (Mathonsi and Thwala, 2012). Types of contracts that are usually used under the non-traditional procurement include design and build contract, management-based contracts and partnering contracts (Hinze, 2013).

2.5 The architecture design process

The architecture design process is one of the key processes in the construction industry. It plays a crucial role towards translating the client requirements into engineering drawings and technical specifications. In addition, decisions taken during this process affect the project performance throughout its life cycle. These decisions include but are not limited to end-users' participation, waste elimination, cost estimation, materials and systems selection and sustainable design features (Bennet, 2003).

2.5.1 Stages of the design process. The Royal Institute of British Architects (RIBA, 2020) plan of work update stated that the typical project life cycle is composed of seven stages,

namely, strategic definition, preparation and briefing, concept design, spatial coordination, technical design, manufacturing and construction, handover and use. Each stage has its own definition, scope of work and participants. This paper will focus on the pre-construction stages:

- *Preparation and Briefing:* The core tasks carried out during this stage involve preparing the project brief including project outcomes and sustainability outcomes; quality aspirations and spatial requirements, undertaking feasibility studies; agreeing project budget; source site information including site surveys; preparing project programme and preparing project execution plan (RIBA, 2020).
- *Concept design:* The concept design stage focusses on preparing the architecture concept incorporating strategic engineering requirements and aligned to cost plan; project strategies and outline specification; agreeing project brief derogations; undertaking design reviews with client and project stakeholders and preparing stage design programme (RIBA, 2020).
- *Spatial Coordination:* The core tasks of the spatial coordination stage is concerned with undertaking design studies, engineering analysis and cost exercises to test architecture concept resulting in spatially; coordinating design aligned to updated cost plan, project strategies and outline specification; initiating change control procedures and preparing stage design programme (RIBA, 2020).
- *Technical design:* The technical design stage is concerned with developing architecture and engineering technical design, preparing and coordinating design team building systems information prepare and integrate specialist subcontractor, building systems information and preparing stage design programme (RIBA, 2020).

2.6 Integrated project delivery

IPD is considered as a whole building design (Fish, 2011). It is a business model for designing, executing and delivering the building through collaborative, integrated and productive techniques and project participants (Anderson, 2010). IPD is an emerging project delivery approach aims to minimise waste in construction projects which leads to optimal improvement in schedule, cost and quality (Matthews and Howell, 2011; Singleton and Hamzeh, 2011). In this approach, all team members including the client, architect, consultants, contractor, subcontractors and suppliers understand the value of their collaboration and are committed to working as a team in the best interests of the project (AIACC, 2007). Moreover, pains and gains are shared between team members (Matthews and Howell, 2011). The fundamentals of the IPD can be applied to a various number of contractual agreements to achieve high effective collaboration between project participants (Perlberg, 2009). These participants are involved in the early stages of the project starting from the design stage till the construction stage along with occupancy and operation stages (AIA, 2010). IPD is a fundamental delivery method for construction projects that intensifies the collaboration and stimulates the communication to be an effective factor. It is implemented quickly due to the involvement of all parties of the design and construction sectors to improve the project performance (Eastman *et al.*, 2008). IPD was initiated as a response to the deficiencies encountered in the traditional procurement approach. Although it has been increasingly adopted in the USA and other parts of the world, its application in the Middle East and Egypt has not commenced yet. Despite the numerous advantages that this new method provides, no clear evidence of IPD implementation can be detected in the region (Rached *et al.*, 2014).

2.6.1 Principles of integrated project delivery. IPD is built on collaboration, which, in turn, relies on mutual respect and trust. In an integrated project, all participants are benefitted and get rewarded by providing them with incentives tied to achieving project objectives. In integrated projects, innovative ideas are encouraged and freely exchanged amongst all participants. In addition, decisions are discussed and evaluated by all members and the best ones for the project are selected unanimously. Moreover, key participants are involved from the earliest stages where their combined knowledge and expertise have great impact on developing informed decisions. Goals in integrated projects are developed early, agreed upon and respected by all participants. An accurate and deep understanding of project participants is valued in a culture that promotes innovation and outstanding performance. Projects that adopt the integrated delivery approach recognise that intensified planning helps in increasing efficiency and savings during execution. Accordingly, the integrated approach is not only reduces design effort but also rather improves the design results, streamline and shorten expensive construction effort. IPD focusses on team performance which is built on open, direct and honest communication amongst all participants. In such delivery system, team responsibilities are clearly defined in a no-blame culture which leads to the identification and resolution of problems and disputes. Technology plays a vital role in maximising functionality and share of information amongst project participants. Finally, leadership in integrated delivery projects is assigned to the team member who is most capable to lead the team to achieve the project goals (AIA, 2007).

2.6.2 Advantages of integrated project delivery. The goal of IPD is to make an exceptional building quicker for less (Thomsen, 2008). This is achieved through a bilateral collaboration and shared goals of all project participants in the IPD process. De Marco and Karzouna (2018) stated that the advantages of using the IPD include better quality, shorter schedule, cost savings, improved productivity, less construction administration, fewer change orders, fewer injuries and more prefabricated materials. Fish (2011) mentioned that it has been predicted upon studies that the construction cost will be lessened by an average of 2%–10% for single projects and 30% over a series of construction projects through the application of an integrated team access. According to Khemlani (2009), the time for the structural design was shortened from 15 months to 8 months. The implementation of building information modeling (BIM) with IPD helps predicting errors beforehand and measuring the chances of success before executing the construction process. This will help reducing the generated waste and the cost needed to improve and fix a building that is already built. Moreover, IPD enables sharing risks and reward through the members of the project.

2.7 Challenges of implementing integrated project delivery

To respond effectively to the challenges that encounter the implementation of IPD in ADFs, these challenges have to be identified and categorised. In-depth literature review highlighted that a number of studies have been conducted to explore the challenges of implementing IPD in the construction industry in general. However, no specific focus was directed to the implementation in ADFs and specifically in Egypt. Hence, this research focussed on the challenges that relate to the design process in ADFs. During the course of this research 30 challenges were extracted from the literature review. Table 1 lists the IPD challenges (IPDCs) and indicates their involved parties and phase of the design process.

2.7.1 The rationale behind the challenges of integrated project delivery implementation in architecture design firms in Egypt. The rationale behind the challenges of IPD implementation in ADFs is given below by a summary of literature. IPDCs were categorised under five categories as follows:

Table 1.
Challenges of IPD implementation in ADFs

		Involved parties								Phase of the design process			
ID	Challenge	Client	Architect	Engineers	Contractor	Subcontractor	Manufacturer supplier	Specialty consultant	Government	Preparation and briefing	Concept design	Spatial coordination	Technical design
IPDC (1)	Poor communication and spirit of collaboration between project stakeholders (AIA, 2007; Mignone *et al.*, 2016)	X	X	X	X	X	X	X	X	X	X	X	X
IPDC (2)	Lack of clients' awareness and knowledge about IPD and alternative options for higher performance (CEC, 2015; Hamzeh *et al.*, 2019)	X								X	X	X	X
IPDC (3)	Reluctance to use new contractual methods and tend to use conventional ones (AIA, 2010; Ghassemi and Becerik-Gerber, 2011; Hamzeh *et al.*, 2019; Nejati, *et al.*, 2014)	X	X	X						X			
IPDC (4)	Unwillingness to cross-disciplinary input during the design phase (AIA, 2010; Ghassemi and Becerik-Gerber, 2011)	X	X	X	X	X	X	X	X	X	X	X	X

(*continued*)

Table 1.

ID	Challenge	Involved parties								Phase of the design process			
		Client	Architect	Engineers	Contractor	Subcontractor	Manufacturer supplier	Specialty consultant	Government	Preparation and briefing	Concept design	Spatial coordination	Technical design
IPDC (5)	Lack of commitment by clients to an integrated approach (AIA, 2010; Atkinson and Westall, 2010)	X								X	X	X	X
IPDC (6)	Unwillingness of contractor's to cooperate during the design process (Ghassemi and Becerik-Gerber, 2011; Nejati *et al.*, 2014)	X	X		X					X	X	X	X
IPDC (7)	Lack of tradespeople or operators involvement (Azhar *et al.*, 2014)	X	X			X	X	X		X	X	X	X
IPDC (8)	Improper selection of IPD-oriented design team (AIA, 2010; Ghassemi and Becerik-Gerber, 2011)		X							X			
IPDC (9)	Lack of open discussion about goals and trust the information provided by prospective teammates (Ghassemi and Becerik-Gerber, 2011; Ashcraft, 2012)	X	X	X	X					X			

(*continued*)

Table 1.

ID	Challenge	Involved parties								Phase of the design process			
		Client	Architect	Engineers	Contractor	Subcontractor	Manufacturer supplier	Specialty consultant	Government	Preparation and briefing	Concept design	Spatial coordination	Technical design
IPDC (10)	Unwillingness of clients, architects and contractors to conduct the project under common interests (O'Connor, 2009)	X	X		X					X			
IPDC (11)	Lack of IPD experience amongst consultants (CEC, 2015)		X	X						X	X	X	X
IPDC (12)	Lack of knowledge and experience about using BIM as an appropriate tool for IPD implementation (CEC, 2015)	X	X	X	X	X	X	X	X	X	X	X	X
IPDC (13)	Slow decision-making process due to the involvement of many participants (Hellmund *et al.*, 2008)	X	X	X	X	X	X	X	X	X	X	X	X
IPDC (14)	Lack of cooperative decision-making skills (AIA, 2007, 2010)	X	X	X	X	X	X	X	X	X	X	X	X
IPDC (15)	Lack of mutual trust between architects and stakeholders (O'Connor, 2009; Shahhosseini, 2013).	X	X	X	X	X	X	X	X	X	X	X	X

(*continued*)

Table 1.

ID	Challenge	Involved parties								Phase of the design process			
		Client	Architect	Engineers	Contractor	Subcontractor	Manufacturer supplier	Specialty consultant	Government	Preparation and briefing	Concept design	Spatial coordination	Technical design
IPDC (16)	Lack of giving priority to the project lifecycle (AIA, 2010; Ghassemi and Becerik-Gerber, 2011)	X	X	X						X	X	X	
IPDC (17)	Unwillingness of the client to share architect and consultant team in the profits of the project (Shahhosseini, 2013)	X								X			
IPDC (18)	Shorter projects cannot spend time on organisational efforts for IPD (Ashcraft, 2010; Cohen, 2010)												
IPDC (19)	Lack of existence of similar IPD contracts (Ghassemi and Becerik-Gerber, 2011; Rached *et al.*, 2014)	X	X							X			
IPDC (20)	Unclear compensation structure for stakeholders' engagement (Ghassemi and Becerik-Gerber, 2011; Ashcraft, 2010; Cohen, 2010)	X	X	X	X	X	X	X	X	X	X	X	X

(*continued*)

Table 1.

ID	Challenge	Involved parties								Phase of the design process			
		Client	Architect	Engineers	Contractor	Subcontractor	Manufacturer supplier	Specialty consultant	Government	Preparation and briefing	Concept design	Spatial coordination	Technical design
IPDC (21)	Lack of governmental incentives, policies or regulations (Hamzeh *et al.*, 2019)								X				
IPDC (22)	Disinclination of stakeholders to take risk (Cohen, 2010; Sive, 2009)	X	X	X	X	X	X	X	X	X	X	X	X
IPDC (23)	Retaining the right of final decision for the client (Nejati *et al.*, 2014)	X								X			
IPDC (24)	Conflict due to multiparty agreement throughout the project lifecycle (AIA, 2007)												
IPDC (25)	Lack of integrated synergy due to lack of necessary technology (Ghassemi and Becerik-Gerber, 2011; Rached *et al.*, 2014)		X							X			
IPDC (26)	Lack of setting sustainability goals by the client to achieve green buildings (AIA, 2007; CEC, 2015)	X								X			

(*continued*)

ID	Challenge	Involved parties								Phase of the design process			
		Client	Architect	Engineers	Contractor	Subcontractor	Manufacturer supplier	Specialty consultant	Government	Preparation and briefing	Concept design	Spatial coordination	Technical design
IPDC (27)	Lack of input provided on constructability and installation processes (CEC, 2015)		X	X	X	X	X	X		X	X	X	X
IPDC (28)	Late decision and unclear expectations by the client (Appelbaum *et al.*, 2009; Azhar *et al.*, 2014)	X								X	X	X	X
IPDC (29)	Loss of focus on the aesthetic components of design due to earlier participation of other stakeholders (Hellmund *et al.*, 2008; Ashcraft, 2012; Sive, 2009)	X	X	X	X	X	X	X	X	X	X	X	X
IPDC (30)	Lack of training and motivation in investing for using IPD (AIA, 2011; Kiani and Khalili Ghomi, 2013)	X	X						X	X	X	X	X

Table 1.

(1) Integration, cooperation, commitment and trust IPDCs (1, 2, 4, 5, 6, 7, 9, 13 and 15).

The architecture design is a pluralistic, creative and iterative process. It is a combination of practicality of science and aesthetic of art. It is mainly concerned with delivering sustainable projects that translate the client needs into designs that specify technical characteristics, functional performance criteria and quality standards. (Othman and Abdelwahab, 2018). Due to its nature, a number of parties are involved in the design process including the client, architect, engineers, consultants and specialists, which requires integration, cooperation, commitment and trust between them. There are a number of challenges that affect the implementation of IPD in ADFs. These challenges include lack of commitment by clients to an integrated approach (AIA, 2010; Atkinson and Westall, 2010). This is also accompanied with the lack of clients' awareness and improper understanding of the benefits of IPD approach on improving the project performance. In addition, contractors, trades people and operators are unwilling to be involved and participate in the design process as the traditional procurement approach separates between design and construction which inhibits contractors and other parties from providing the design team with constructive comments and feedback to improve the project design (Ghassemi and Becerik-Gerber, 2011; Nejati *et al.*, 2014; Azhar *et al.*, 2014). One of the main challenges that encounter the implementation of IPD during the design process is the lack of trust between the project stakeholders. The segmented organisational configurations in the construction industry often leads to adversarial relationships, defensive behaviour and inefficient performance (Kadefors, 2004; Lau and Rowlinson, 2011). Results of a survey published by Construction Management Association of America in 2005 showed that, the client's top concerns are:

- trust and integrity in the construction process; and
- coordination and collaboration amongst team members (Thomsen *et al.*, 2010).

Mistrust between project participants is obvious in the form of unwillingness to conduct cross-disciplinary discussion and contribution during the design phase (AIA, 2010; Ghassemi and Becerik-Gerber, 2011), lack of developing common goals and trust the information provided by prospective participants (Ashcraft, 2012). Furthermore, poor communication and spirit of collaboration between project stakeholders (AIA, 2007; Mignone *et al.*, 2016) leads to slow decision-making process due to the involvement of many participants (Hellmund *et al.*, 2008). Trust building is often affiliated with the spirit of partnering. Hancher (1989 cited in Wong *et al.*, 2008) promoted the use of partnering instead of traditional approach as a means to improve contracting relationship. Cook and Hancher (1990) suggested that information sharing is the essential trust-builder. It was reported that appropriate and honest information sharing can enhance mutual understanding and expectations amongst the partnering members. In general, integrated delivery projects achieve better quality and safety, create new direction of technology usage and make more business. Mutual trust has been identified as one of the most important success factors in maintaining partnering relationship (Black *et al.*, 2000).

(2) Knowledge, experience skills and decision-making related IPDCs (2, 11, 12 and 14).

Chambers English Dictionary (2014) defined "Knowledge" as the theoretical and practical understanding of a subject, "experience" as the process of getting knowledge or skills from doing, seeing or feeling things and "Skills" as the ability

to do an activity or job well due to practicing it. The construction industry is a knowledge intensive business and many of the decisions made during the design process depend on the knowledge, experience and skills of the project participants. As construction projects became more complex, innovative and clients turned out to be more demanding, ADFs must consider alternative approaches for delivering sustainable projects and use the benefits of newly introduced approaches such as IPD. However, due to the lack of knowledge of clients (CEC, 2015; Hamzeh *et al.*, 2019) about these new approaches, they tend to adopt other procurement approaches that have been tested before. In addition, lack of experience amongst investors and consultants due to shortage of practicing similar procurement approaches obstruct adopting IPD approach. Another challenge to IPD implementation in ADFs is the lack of knowledge and experience of architects about the role that BIM can play towards the effective implementation of IPD during the design process (CEC, 2015). Furthermore, lack of skills of project participants for conducting cooperative decision-making process (AIA, 2007, 2010) as a result of poor training and inappropriate investment in enhancing human resources capabilities and motivation leads to poor adoption of IPD approach.

(3) Cultural related IPDCs (3, 18 and 22).

Culture is the set of shared values, beliefs, behaviours, goals, attitudes, practices that characterizes an institution, organisation, society or group. From a business perspective, culture is the sum of peoples' habits related to how they get their work done. People talk about their company's culture all the time as a reason why they can or cannot do something. Organisation's culture is enabling or inhibiting change or resistance. Annual reports proudly refer to company's culture as an invaluable asset (Mann, 2005). Changing people culture is a difficult task. There are different types of organisational changes including: strategic change, structural change, process-oriented change and people-centered change. The later is focussed on culture change in organisations. People-centered change aims to change the attitudes, behaviors, skills or performance of employees. It involves communicating, motivating, leading and interacting within groups. This focus may entail changing how problems are identified and solved, the way employees learn new skills, and how employees perceive themselves, their jobs and the organisation. Some people-centered changes may involve only incremental changes or small improvements in a process (Benowitz, 2001). Due to the reluctance to change in the construction industry, changing organisational culture is essential for successful implementation of IPD in ADFs. Cultural challenges that encounter IPD implementation in ADFs include unwillingness to use new contractual methods and tend to use conventional ones that have been applied successfully before (AIA, 2010; Ghassemi and Becerik-Gerber, 2011; Nejati *et al.*, 2014; Hamzeh *et al.*, 2019). The IPD contractual relationship requires a project team culture that is based on taking risk, exchanging knowledge and sharing profit as well as mutual trust. This necessitates conducting culture changes to all parties involved in the design process to align their culture with the project culture. Moreover, other culture issues that obstruct implementing IPD in ADFs is believing that shorter projects cannot spend time on organisational efforts for IPD (Ashcraft, 2010; Cohen, 2010).

(4) Legal and contractual IPDCs (19, 20, 21, 22, 23 and 24).

Several challenges to IPD implementation in the design process have been classified under legal and contractual issues. One of the main challenges is the lack of existence of similar IPD contracts. This inhibits drafting IPD contacts and understanding the rights and obligations of each party, as well as identifying the

compensation structure for stakeholders' engagement (Ghassemi and Becerik-Gerber, 2011; Ashcraft, 2010; Cohen, 2010). Being the largest client for projects in Egypt, the governmental tendering process and selection criteria for architects, contractors and other involved parties is based on the lowest price, where the IPD section criteria is value based. Accordingly, the government is required to establish incentives programmes, polices and regulations that encourage, organize and facilitate the implementation of IPD in construction projects (Hamzeh *et al.*, 2019). This will help overcoming the challenge of stakeholders' disinclination of taking risk (Cohen, 2010; Sive, 2009) and reducing the conflict between multi-parties involved throughout the project lifecycle. Despite the contractual fact that the client has the right for the final decision (Nejati *et al.*, 2014), it seems inappropriate if the client is naive and has no previous experience in construction or lack of awareness about IPD and alternative procurement approaches (CEC, 2015; Hamzeh *et al.*, 2019).

(5) Technical and financial IPDCs (8, 16, 17, 25, 26, 27, 28, 29 and 30).

There are a number of technical and financial challenges that affect the implementation of IPD in ADFs. On the one hand, the technical side of these challenges begins with the improper selection of IPD oriented design team. This results in shortage of advising the client or the investor to establish sustainability objectives and consider the project life cycle during the design process (AIA, 2010; Ghassemi and Becerik-Gerber, 2011). In addition, such team lacks providing valuable input usually resulted from the constructability exercises and installation process (CEC, 2015) which affects the project performance throughout its life cycle. Moreover, late decisions and unclear expectations of the client inhibit the integration of other stakeholders in the design process and increase the project duration (Appelbaum *et al.*, 2009; Azhar *et al.*, 2014). A balance is needed between the aesthetic components of design and focus of stakeholders during the design process (Hellmund *et al.*, 2008; Ashcraft, 2012; Sive, 2009). ADFs resist the integration of contactors, suppliers and manufacturers as their area of concern is related to construction and operation issues which leads to loss of focus on aesthetic appearance of buildings. On the other hand, the financial challenges that affect the implementation of IPD in ADFs relate to the investment in human resources in terms of providing the necessary technology for collaboration and synergy between the project participants (Ghassemi and Becerik-Gerber, 2011; Rached *et al.*, 2014). In addition, the lack of providing training programmes and motivation discourage architects from taking further steps towards implementing IPD approach during the design process and affect the firm's competiveness and profitability (AIA, 2011; Kiani and Khalili Ghomi, 2013).

To recap, the topics covered in the literature review section shed light on the deficiencies of the traditional procurements approaches and the values expected to be achieved through the implementation of IPD. However, literature review also identified the challenges that encounter the implementation of IPD, which requires a comprehensive research methodology to overcome these challenges.

3. Research methodology

3.1 Research strategy/approach

The research attempts to develop a practical framework to overcome the challenges of IPD implementation in ADFs in Egypt. Through comparing the research aim, objectives and characteristics with the aim, objectives and characteristics of the different research approaches (Holt, 1998) this research was descriptive in nature and adopted the applied

approach to achieve its aim and objectives. Quantitative and qualitative techniques were used for data collection and analysis. Data collection is a principal activity in the research process. Data were collected from different sources, using different methods to achieve certain objectives. This was known as "triangulation", which increased the reliability and validity by verifying findings of data from one source with other sources. This strategy reduces the risk and bias associated with using specific methods (Maxwell, 1996).

- Data collection was based on literature review, case studies and survey questionnaire. Firstly, literature review used textbooks, academic and peer-reviewed journals, conference and seminar proceedings, dissertations and theses, organisations and government publications, internet and related websites to examine the nature of the construction industry in Egypt, value in construction, traditional procurement approaches, IPD and challenges of implementing IPD in ADFs. Secondly, four case studies collected from USA, India and Egypt were analysed to investigate the value delivered to the client or missed due to the use of IPD and traditional procurement approaches, respectively. Thirdly, results of a survey questionnaire conducted with a representative sample of ADFs in Egypt were presented and analysed to investigate the perception of ADFs towards the challenges of IPD implementation during the design process. The survey consisted of open ended questions (e.g. thoughts and opinions) and close ended questions (e.g. Yes/No questions, rating questions based on 1-5 Likert scale). A pilot study of the survey was tested with colleagues to determine its effectiveness and problems. After going over the responses of the preliminary test and making changes, the questionnaire was ready for formal testing (Baker, 1994; Czaja and Blair, 1996).
- A three-stage data analysis approach was adopted. The first stage was to measure the central tendency and dispersion of the questionnaire responses. The measure of central tendency was used to get an overview of the typical value for each variable by calculating the mean, median and mode. The measure of dispersion was used to assess the homogenous or heterogeneous nature of the collected data by calculating the variance and the standard deviation (Bernard, 2000). Analysis of the collected data showed close values of means, medians and modes, indicated typical central values and showed also low values of variance and standard deviation. This confirmed the quality and the homogeneity of the collected data and a low degree of dispersion resulting in reliable findings. Secondly, as not all challenges have the same impact on obstructing the adoption of IPD in ADFs, the relative importance index (RII) was used to differentiate between these challenges using the formula of: $RII = \Sigma W/AN$, where W = weighting given to each challenge by the respondents on a Likert scale from 1 to 5, A = highest weight (5 in our case); and N = total number of sample (Shash, 1993; Kometa and Olomolaiye, 1997). The data were analysed with the aid of Microsoft Excel spreadsheet. Finally, to investigate the correlation between the IPDCs, Spearman correlation test was conducted using Statistical Package for the Social Sciences "SPSS" to perform this type of analysis. As there is no quantification without qualification and no statistical analysis without interpretation (Bauer and Gaskell, 2000) during the course of this research, both approaches of quantitative and qualitative data analysis were used.
- Based on the results of data collection and data analysis, a framework was developed to facilitate the implementation of IPD during the design process in ADFs in Egypt, see Figure 1.

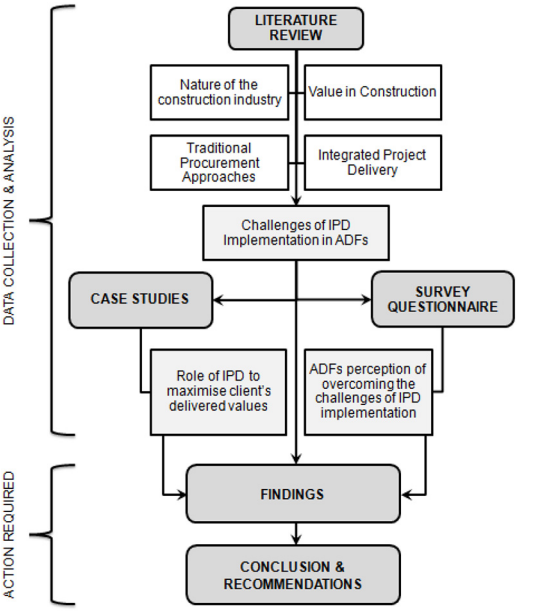


Figure 1.
Research methodology

3.2 Population and sampling questionnaire survey sample

The sampling plan using a random probability sampling method was applied to the population size which was 44 (ADFs) registered in the Egyptian Engineers Syndicate (EES, 2019). This allowed every unit an equal chance of being included in the sample (Hannagan, 1986). This helped selecting a representative and non-biased sample. To calculate the sample size, the next two equations were used (FluidSurveys Team, 2014).

$$\text{Sample Size Calculation} = \frac{\text{Distrubution of } 50\%}{\left[\text{Margin of error}\%\,/\,\text{Confidence Level Score}\right]^2}$$

$$\text{True Sample} = \frac{\text{Sample Size} \times \text{Population}}{\text{Sample Size} + \text{Population} - 1}$$

In this research, the confidence level chosen is 95% and the margin of error is 5%. The confidence level score corresponding to the confidence level of 95% is 1.96.

$$\text{Sample Size} = \frac{0.5 \times (1 - 0.5)}{\left[0.05\,/\,1.96\right]^2} = 384.16$$

$$\text{True Sample} = \frac{384.16 \times 44}{384.16 + 44 - 1} = 39.57 \sim 40$$

However, as the true sample size is only different from the population size by 4; the population size would be considered entirely for the survey questionnaire. It worth

mentioning that the names of these design firms were suppressed for the purpose of security according to their request.

4. Case studies

The case study is a research method used to describe and analysis an individual matter, phenomenon, event or project with the purpose to identify variables, structures, forms and orders of interaction between the participants in the situation or to assess the performance of work or progress in development (Sturman, 1997). Within this research, four case studies were selected (two cases from USA, one case from India and one from Egypt). The selection of the first two cases was based on the values achieved through application of IPD, where the selection of the other two cases was based on the values that were missed due to the application of the traditional procurement in addition to the similar characteristics of the construction industry in India and Egypt as developing countries.

The benchmark criteria used for analysing these cases was based on the terminal value and instrumental value (Meng, 2012; Boyd and Chinyio, 2006; Aliakbarlou *et al.*, 2017) explained in section 2.3.1, see Table 2.

4.1 Case study (1): Seattle Children's Bellevue Clinic, WA, USA

The clinic is a two storey building with 80,000 gross square feet and an approximate construction cost of US$75m (AIA, 2010). The project used an Integrated Form of Agreement (IFoA) contract which allows the client, architect, design team and general contractor to be all in one common contract. There was an early contribution in the design phase from the mechanical and electrical sub-contractors. Although not all of the project participants had worked on the IPD process before, but through training they were able to adapt easily to the process. IPD allows for sharing risks and rewards, so the participants have changed their goals by making the main goal is the successful completion of the project (Kim and Dossick, 2011). Accordingly, the project was delivered three months ahead of schedule with US$30m saved from the initial estimates. The project goal exceeded the company's expectations as the building attained LEED Gold Certification in 2001 due to the utilisation of IPD benefits (AIA, 2010). The target value design was taken into consideration, along with BIM and the collaboration between the project team members. The utilisation of BIM helped the stakeholders to visualise scope models differences, use better understanding of the overall design, precise selection of materials and facilitate the construction process (Kim and Dossick, 2011). The collaboration between the clinic staff and patients helped reducing 27% of the square footage and understanding the occupants' needs (AIA, 2010). The use of IPD allowed the project team to outpace sustainability, lessen energy demands and analyse incentives to reduce operation costs. The money that was saved due to the IPD process was re-established into the building to add more sustainability features. This case study includes a number of aspects that facilitated IPD implementation and overcome many of the challenges highlighted in Table 1. These aspects include using integrated form of contract, good communication and collaboration between the project team and stakeholders at early stages of the project, providing necessary IPD training, sharing risks and rewards, using BIM facilities for collaboration and setting sustainability objectives during the design process.

4.2 Case study (2): Lawrence and Schiller: Marketing and Advertising Agency, USA

Lawrence and Schiller Agency was looking for an interior design office to renovate and remodel the 7,000 square foot office. Canfield Business Interiors helped remodel the office through the implementation of IPD. Canfield wanted to test out an IPD approach with

Table 2.
Matrix for case studies in relation to delivered client values

	Terminal value			Instrumental value				
	Time	Cost	Quality	Participation	Relationships	Communication	Coordination	Problem-solving
Case (1)	Increased	Increased	Increased	Increased	Increased	Increased	Increased	Increased
Case (2)	Increased	Increased	Increased	Increased	Increased	Increased	Increased	Increased
Case (3)	Reduced	Reduced	Reduced	Reduced	Reduced	Reduced	Reduced	Reduced
Case (4)	Reduced	Reduced	Reduced	Reduced	Reduced	Reduced	Reduced	Reduced

Source: Developed by the authors

collaborators. As a marketing office, they thought that the implementation of a new method such as IPD would be innovative and a new approach. The integrated project team members comprising interior designers, architects, construction manager, mechanical contractor and electrical contractors. It was the first time for Lawrence and Schiller to have all parties involved in one contract. Although they have been collaborating for years but using the design-build approach, which did not give the parties the validity to be all involved and collaborated together at the same time. Implementing the IPD approach was an advantage for all involved parties because of the experience they gained in a fast-changing economy and would raise the market advantage of Lawrence and Schiller. IPD was a good choice as the marketing office was trying to reduce the original design estimate from US$700k to US $500k which made the cost predictability an important factor for delivering a better client value. The architect used BIM in this project to execute the work and to explain to the client the project visually, but not as a tool for enhancing the collaboration. BIM has not been used because of the small scale of the project and the size of the firm. However, the team acknowledges the fact that BIM is a crucial tool for a more successful market and it is the direction that most of the firms go to nowadays. This case study includes a number of aspects that facilitated IPD implementation and overcome many of the challenges highlighted in Table 1. These aspects include taking the initiative to use new contractual methods, collaboration between project participants, sharing rewards, using BIM partially to communicate with the client.

4.3 Case study (3): Dr. Prabhu Halakatti Hospital, Belagavi, India

The third case study is about a hospital project constructed in India using the traditional procurement approach. The choice of this approach was to use the features of getting the design finalised before contractors are appointed, so there is clarity about the project requirements and expected cost. However, and according to the observations of the project team conducted during the planning and construction phases, there were some problems that faced the construction process. These problems included poor communication between the client, architect, contractor and management team, in addition to project delay and cost overrun due to client changes conducted during the construction phase. The results of the case study showed that it was not a promising future for the implementation of the traditional procurement due to the weak conclusions and unexpected outcome towards this method. The client of the hospital was not encouraged to implement this method in future projects and started to search and study for another method and one method that could be used is the integrated approach.

4.4 Public Faculty Building, Egypt

The project is a faculty building in one of the public universities in Egypt. The building consists of five floors with an area of 7,200 square meters and estimated budget of EGP 33 million. The building adopted the Design Bid Build approach. Within this approach, the contractor and other construction professionals are not included in the design process. This prevented providing the design team with feedback to improve the project design. Accordingly, a number of issues appeared during the construction process which resulted in reducing the value delivered to the client. Examples of these issues include adding new windows to increase the natural lighting to corridors and reduce the use of artificial light. In addition, changing the roof insulation type to a more advanced and better-performing one which will help reducing the air conditioning capacity and operation cost. Moreover, changing the traditional structural system of one of the floors from beam system to a flat slab system to suit the function of the floor. These modifications resulted in extra cost of

EGP 550,397 and 75 days delay. These issues could be avoided through adopting a more integrated approach where all project participants communicate during the design process and collaborate towards developing better design (Ahmed *et al.*, 2016).

5. Results

This section presents and analyses the results of a survey questionnaire conducted with a representative sample of ADFs in Egypt to examine their perception towards the challenges of IPD implementation during the design process.

5.1 Response rate and respondents' profile

Out of 44 ADFs invited to participate in the study, only 30 firms responded to the survey questionnaire which represents 68.2%. In total, 25 firms are sole proprietors and the rest are partnerships. The number of years of experience of these firms in the construction industry ranges from 5–50 years. They are involved in all types of projects including residential, commercial, medical, industrial, cultural, business, recreational and educational. The size of these firms ranges from 10–50 employees with architecture, engineering and construction backgrounds.

5.2 Perception, advantage and disadvantage of traditional procurement approach in architecture design firms in Egypt

All respondents mentioned that they are aware and understand the traditional procumbent approach used in construction projects. Figures 2 and 3 show the results of ADFs responded to the survey questionnaire with regard to the advantages and disadvantages of the traditional procurement approach.

5.3 Perception, ranking and relative importance of integrated project delivery challenges in architecture design firms in Egypt

In total, 83.33% of respondents mentioned that they are aware and understand the methodology and advantages of the IPD approach. However, they mentioned that this approach is not implemented in ADFs in Egypt due to a number of challenges. Respondents were asked to rank the challenges of IPD identified from literature review in relation to the

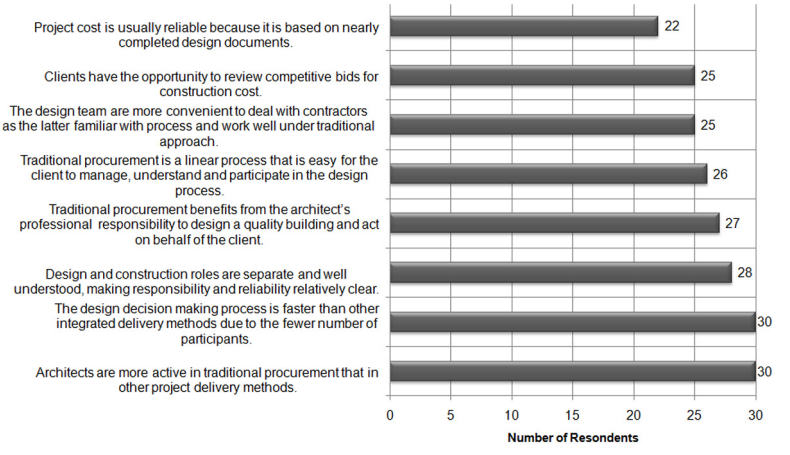


Figure 2.
ADFs' response regarding the advantage of traditional procurement

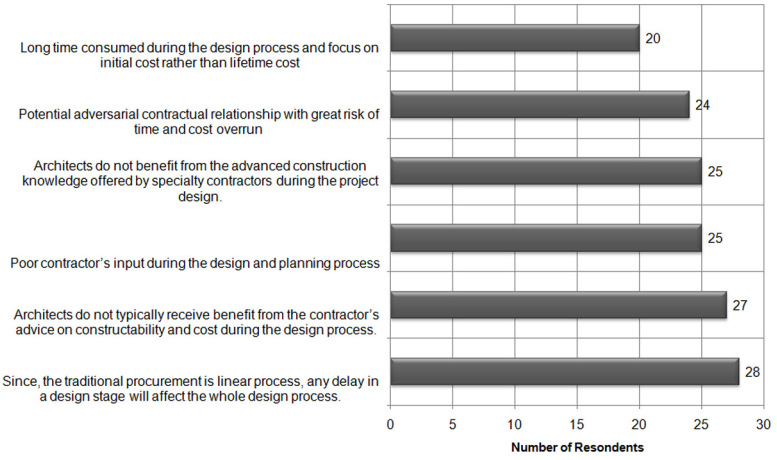


Figure 3.
ADFs' response regarding the disadvantage of traditional procurement

Egyptian context. Table 3 shows the measure of central tendency and dispersion of all challenges on a scale of 1–5 (where 1 = least influential and 5 = highest influential). To further investigate the data, a RII was used to rate IPDCs according to their influence. As would be expected, while some IPDCs were highly rated, others do not, see Figure 4. Results showed that IPDCs could be categorised as per their influence as follows:

(1) Firstly, the high to very high influential IPDCs with RIIs above 0.800, which includes:

- Poor communication and spirit of collaboration between project stakeholders.
- Lack of clients' awareness and knowledge about IPD and alternative options for higher performance.
- Reluctance to use new contractual methods and tend to use conventional ones.
- Unwillingness to cross-disciplinary input during the design phase.
- Lack of commitment by clients to an integrated approach.
- Unwillingness of contractor's to cooperate during the design process.
- Lack of trades people or operators involvement.
- Improper selection of IPD-oriented design team.
- Lack of open discussion about goals and trust the information provided by prospective teammates.
- Unwillingness of clients, architects and contractors to conduct the project under common interests.
- Lack of IPD experience amongst consultants.
- Lack of knowledge and experience about using BIM as an appropriate tool for IPD implementation.
- Slow decision-making process due to the involvement of many participants.

For example, "Poor communication and spirit of collaboration between project stakeholders" was ranked the highest influential challenge with Mean (4.93/5), Median and Mode (5/5), V (0.81), SD (0.90) and RII (0.99). These results are in

Table 3.
Challenges of integrated project delivery implementation in architecture design firms against their measures of central tendency, dispersion and ranking

No. (1)	Challenges of the construction supply chain (2)	Mean (3)	Median (4)	Mode (5)	V (6)	SD (7)	Percentage of respondents scoring <3 (8)	3–4 (9)	>4 (10)	RII (11)	Rank (12)	Final rank (13)
IPDC (1)	Poor communication and spirit of collaboration between project stakeholders	4.93	5	5	0.81	0.90	0	2	28	0.99	(1)	1
IPDC (2)	Lack of clients' awareness and knowledge about IPD and alternative options for higher performance	4.90	5	5	0.80	0.89	0	3	27	0.98	(2)	2
IPDC (3)	Reluctance to use new contractual methods and tend to use conventional ones	4.83	5	5	0.78	0.88	0	4	26	0.97	(3)	3
IPDC (4)	Unwillingness to cross-disciplinary input during the design phase	4.80	5	5	0.77	0.88	0	5	25	0.96	(4)	4
IPDC (5)	Lack of commitment by clients to an integrated approach	4.77	5	5	0.76	0.87	0	6	24	0.95	(5)	5
IPDC (6)	Unwillingness of contractors to cooperate during the design process	4.70	5	5	0.74	0.86	0	7	23	0.94	(6)	6
IPDC (7)	Lack of trades people or operator involvement	4.57	5	5	0.70	0.83	0	13	17	0.91	(7)	7
IPDC (8)	Improper selection of IPD-oriented design team	4.50	5	5	0.68	0.82	0	14	16	0.90	(8)	8
IPDC (9)	Lack of open discussion about goals and trust the information provided by prospective teammates	4.47	4.5	5	0.67	0.82	0	15	15	0.89	(9)	9
IPDC (10)	Unwillingness of clients, architects and contractors to conduct the project under common interests	4.40	4.5	5	0.65	0.80	1	14	15	0.88	(10)	10
IPDC (11)	Lack of IPD experience amongst consultants	4.33	4	5	0.63	0.79	0	16	14	0.87	(11)	11
IPDC (12)	Lack of knowledge and experience about using BIM as an appropriate tool for IPD implementation	4.13	4	5	0.57	0.75	0	18	12	0.83	(12)	12
IPDC (13)	Slow decision-making process due to the involvement of many participants.	4.07	4	5	0.55	0.74	0	19	11	0.81	(13)	13
IPDC (14)	Lack of cooperative decision-making skills	3.97	4	4	0.52	0.72	1	19	10	0.79	(14)	14
IPDC (15)	Lack of mutual trust between architects and stakeholders	3.90	4	4	0.51	0.71	1	20	9	0.78	(15)	15
IPDC (16)	Lack of giving priority to the project lifecycle	3.87	4	4	0.50	0.71	1	21	8	0.77	(16)	16
IPDC (17)	Unwillingness of the client to share architect and consultant team in the profits of the project	3.77	4	4	0.47	0.69	3	19	8	0.75	(17)	17
IPDC (18)	Shorter projects cannot spend time on organisational efforts for IPD	3.77	4	4	0.47	0.69	2	20	8	0.75	(17)	18
IPDC (19)	Lack of existence of similar IPD contracts	3.67	4	4	0.45	0.67	5	17	8	0.73	(18)	19
IPDC (20)	Unclear compensation structure for stakeholders' engagement	3.63	4	4	0.44	0.66	6	15	9	0.73	(18)	20

(*continued*)

No. (1)	Challenges of the construction supply chain (2)	Mean (3)	Median (4)	Mode (5)	V (6)	SD (7)	Percentage of respondents scoring <3 (8)	3–4 (9)	>4 (10)	RII (11)	Rank (12)	Final rank (13)
IPDC (21)	Lack of governmental incentives, policies or regulations	3.60	4	4	0.43	0.66	6	16	8	0.72	(19)	21
IPDC (22)	Disinclination of stakeholders to take risk	3.57	4	4	0.42	0.65	6	16	8	0.71	(20)	22
IPDC (23)	Retaining the right of final decision for the client	3.50	4	4	0.41	0.64	7	15	8	0.70	(21)	23
IPDC (24)	Conflict due to multiparty agreement throughout the project lifecycle	3.47	4	4	0.40	0.63	7	16	7	0.69	(22)	24
IPDC (25)	Lack of integrated synergy due to lack of necessary technology	3.43	4	4	0.39	0.63	8	15	7	0.69	(22)	25
IPDC (26)	Lack of setting sustainability goals by the client to achieve green buildings	3.43	4	4	0.39	0.63	7	19	7	0.69	(22)	26
IPDC (27)	Lack of input provided on constructability and installation processes	3.33	4.5	3	0.37	0.61	7	17	6	0.67	(23)	27
IPDC (28)	Late decision and unclear expectations by the client	3.30	3	3	0.36	0.60	8	16	6	0.66	(24)	28
IPDC (29)	Loss of focus on the aesthetic components of design due to earlier participation of other stakeholders	3.23	3	4	0.35	0.59	8	17	5	0.65	(25)	29
IPDC (30)	Lack of training and motivation in investing for using IPD	3.20	3	4	0.34	0.58	9	16	5	0.64	(26)	30

Table 3.

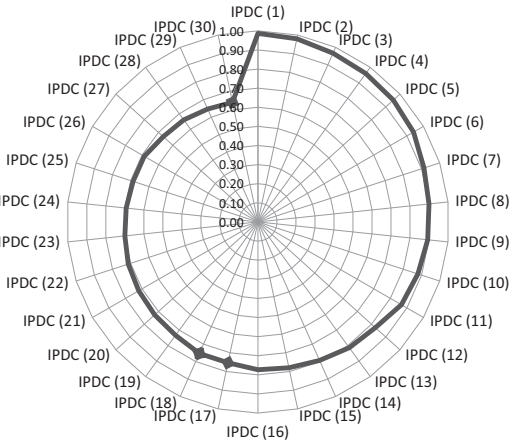


Figure 4.
RII of IPDCs implementation in ADFs

line with literature review because IPD was built on communication between project participants and the nature of the traditional procurement approach which separates between design and construction obstructs communication and collaboration between project participants. Another example is "Unwillingness of contractors to cooperate during the design process" which was ranked the 6th influential challenge with Mean (4.70/5), Median and Mode (5/5), V (0.74), SD (0.68) and RII (0.94). These results are corresponding to literature review and case studies because the dominant culture in traditional procurement ignores the contractors' contribution into the design process and accordingly not inviting them to participate and play a role (Ghassemi and Becerik-Gerber, 2011; Nejati *et al.*, 2014). This highlights the need to culture change in the construction industry towards adopting new ideas and recognising the role of other parties that reflects positively on project performance. One more example is "Slow decision-making process due to the involvement of many participants" which was ranked the 13th influential challenge with Mean (4.07/5), Median (4/5) and Mode (5/5), V (0.55), SD (0.74) and RII (0.81). These results reflect why ADFs prefer the traditional procurement approach as the decisions are made faster due to the limited number of participants in the design process. Despite the benefits of discussion and engagement of many project participants, it takes long time to get ideas approved and decisions made.

(2) Secondly, the average to high influential IPDCs with RIIs lying between 0.600 and 0.800, which includes:

- Lack of cooperative decision-making skills.
- Lack of mutual trust between architects and stakeholders.
- Lack of giving priority to the project lifecycle.
- Unwillingness of the client to share architect and consultant team in the profits of the project.
- Shorter projects cannot spend time on organisational efforts for IPD.

- Lack of existence of similar IPD contracts.
- Unclear compensation structure for stakeholders' engagement.
- Lack of governmental incentives, policies or regulations.
- Disinclination of stakeholders to take risk.
- Retaining the right of final decision for the client.
- Conflict due to multiparty agreement throughout the project lifecycle.
- Lack of integrated synergy due to lack of necessary technology.
- Lack of setting sustainability goals by the client to achieve green buildings.
- Lack of input provided on constructability and installation processes.
- Late decision and unclear expectations by the client.
- Loss of focus on the aesthetic components of design due to earlier participation of other stakeholders.
- Lack of training and motivation in investing for using IPD.

For example, "Unwillingness of the client to share architect and consultant team in the profits of the project" which was ranked 17th influential challenge with Mean (3.77/5), Median and Mode (4/5), V (0.47), SD (0.69) and RII (0.75). These results are in line with literature review as the collaborative nature of IPD contributes towards reducing project cost and sharing rewards and if the client is not willing to share the project team with a percentage of this saving then the implementation of IPD will be difficult. Another example is "Lack of governmental incentives, policies or regulations" which was ranked the 21st challenge with Mean (3.6/5) and Median and Mode (4/5), V (0.43), SD (0.66) and RII (0.72). These results are corresponding to literature review which mentioned that despite the attracting growing attention to IPD, evidence shows small percentage of real-life projects that use this approach due to lack of involvement, support and commitment of governments and authorities, as well as the absence of a stable legal and regulatory framework (Hamzeh *et al.*, 2019). This issue is intensified in developing countries such as Egypt, where regulations either lacking or not adhered to. One more example is "Lack of training and motivation in investing for using IPD" which was ranked the lowest affecting challenge with Mean (3.2/5) and Median (3/5) and Mode (4/5), V (0.34), SD (0.58) and RII (0.64). These results confirms literature findings which states that despite the necessity of providing training programmes and motivations to encourage architects to implement IPD, the current culture in the construction industry generally and ADFs, in particular, consider training as unnecessary activity to achieve organisation objectives and adopt new approaches such as IPD (Loosemore *et al.*, 2003). Moreover, case studies showed that providing training enabled project participants to adapt easily to the IPD implementation process.

5.4 Correlation analysis of integrated project delivery challenges in architecture design firms in Egypt

A correlation analysis test was conducted on all IPDCs to investigate their correlations. Spearman correlation test was carried out through using SPSS to perform this type of analysis as all the variables are ordinal and categorical. While, SPSS highlighted that some challenges are correlated, others were not. For instance, there is a correlation between IPDC 10 and IPDC 11 which is supported by literature review. This is because the lack of IPD experience amongst

consultants (CEC, 2015) leads to unwillingness of project participants such as clients, architects and contractors to conduct the project under common interests (O'Connor, 2009). In addition, there is a correlation between IPDC 21 and IPDC 30. This correlation is corresponding to literature findings because lack of establishing incentives, polices and regulations by government (Hamzeh *et al.*, 2019) to implement IPD gives an indication that such procurement is not supported or desired by the government. Accordingly, ADFs are not encouraged or motivated to invest in training architects to use IPD procurement (AIA, 2011; Kiani and Khalili Ghomi, 2013). Moreover, there is a correlation between IPDC 16 and IPDC 17. This is correlation is also supported by literature review because when the client is reluctant to share the profit gained from the creative ideas proposed by different project participants (Shahhosseini, 2013), they will believe that they are expelled from the project and will not be willing to give any advice or priority to ideas that enhance the performance of the project throughout its life cycle (AIA, 2010; Ghassemi and Becerik-Gerber, 2011). On the other hand, SPSS showed no correlation between IPDC 6 and IPDC 8. This is because the unwillingness of contractors to cooperate during the design process (Ghassemi and Becerik-Gerber, 2011; Nejati *et al.*, 2014) is mainly based on the dominant traditional procurement culture which separates between design and construction and not necessary linked to the improper selection of IPD oriented design team (AIA, 2010; Ghassemi and Becerik-Gerber, 2011).

6. A proposed framework for integrated project delivery implementation in architecture design firms in Egypt

According to the results of the literature review, case studies and survey questionnaire, the research proposed the development of a framework to facilitate the implementation of IPD in ADFs in Egypt.

6.1 Definition and background

Framework is defined as a set of notions, techniques and tools in a planned outline to complete a product, process and design (EDMS, 2010). The Integrated Project Delivery Implementation Framework (hereinafter referred to as "the framework" or "IPDIF") is a proposed framework developed by this research to facilitate implementing IPD in ADFs in Egypt.

6.2 The need for the framework

The IPDIF is needed so as to provide a structured plan for senior management in ADFs to overcome the challenges of implementing IPD during the design process in ADFs. The traditional procurement approaches, commonly adopted in construction are insufficient in terms of fulfilling the requirements of complex and innovative projects and the increasing demand of sustainable project by clients and end users. The necessity of this framework stems from the importance to use the different skills and capabilities of various project participants towards enhancing the performance of the project during the design process and the delivered value to the client. Moreover, the framework is required to fill the gap in construction literature towards IPD implementation in ADFs.

6.3 Development of the framework

The development of the framework was based on the results of the literature review, case studies and data analysis gleaned from the survey questionnaire. Literature review showed that there are a number of challenges that obstruct the implementation of IPD in the construction industry, especially in ADFs. In addition, results of the case studies showed that the firms that adopted IPD succeeded in delivering values to their clients, where the

firms that adopted traditional approaches failed to deliver their clients with the expected values. Moreover, these findings are in line with results of the survey questionnaire. Respondents highlighted the disadvantages of traditional procurement approach and the advantages of IPD. Furthermore, they confirmed that IPD is not adopted in ADFs in Egypt and ranked the challenges according to their influence on a scale of 1 to 5.

6.4 Aim of the framework

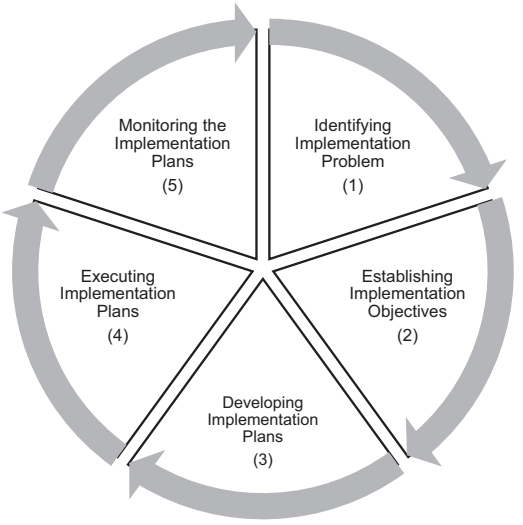
The IPDIF is an innovative conceptual business improvement tool used to facilitate the implementation of IPD during the design process in ADFs in Egypt. This will help enhancing the values delivered to clients and improving the performance of projects throughout their life cycle.

6.5 The conceptual description of the framework

The framework consists of five functions, namely:

(1) Identifying implementation problem;
(2) Establishing implementation objectives;
(3) Developing implementation plans;
(4) Executing implementation plans; and
(5) Monitoring the Implementation Plans (Figure 5).

6.5.1 Identifying implementation problem. The "identifying implementation problem" function is an essential activity of this framework because it enables ADFs to identify the core challenge that obstruct the implementation of IPD into the design process in ADFs. It is of prime importance to build an effective team (including a competent team leader) to carry out the implementation study. Achieving a balance between the need for participants who represent various areas of expertise and possess diverse background is fundamental for



Source: Developed by the authors

Figure 5. Functions of the framework

accomplishing the study objectives. The study team should contain between 6 and 12 full-time participants to maintain optimum productivity (Norton and McElligott, 1995). Performing an early orientation meeting will help in establishing strategic issues such as study duration, resources required and assigning responsibilities to team members. Senior management support will facilitate the provision of needed resources and the adoption of study decisions and recommendations. Data collection methods (i.e. literature review, survey questionnaire, interviews and case studies) and data analysis techniques (i.e. quantitative and qualitative) have to be defined and used. Brainstorming technique, team consensus and evaluation matrix have to be used for identifying the root challenges and rank them according to their importance. Based on the literature review conducted in this research, the challenges that ADFs may encounter could be classified as:

- Integration, cooperation, commitment and trust challenges;
- Knowledge, experience skills and decision-making challenges;
- Cultural challenges;
- Legal and contractual challenges; and
- Technical and financial challenges.

Such classification will help ADFs to take proper action to resolve each challenge.

6.5.2 Establishing implementation objectives. Towards facilitating the implementation of IPD in ADFs, the objectives of implementing IPD into the design process in ADFs have to be adequately established and agreed by all participants. This could be achieved through using brainstorming technique and team consensus to generate and select objectives that address the identified problem. Establishing implementation objectives gives team members ownership to these objectives and encourages the study team to accomplish them. Evaluation matrix will be used to rank these objectives according to their significance. In addition, this function will result also in defining the criteria to be used to measure the success of implementing IPD in the design process in ADFs in Egypt. The objectives of implementation could be:

- Increasing collaboration, trust and transparency between the client, architect, engineers, contractors, sub-contractors and suppliers.
- Improving project constructability through making better use of different project participants.
- Enhancing the values delivered to the client.
- Reducing project cost and duration.

6.5.3 Developing implementation plans. The "Developing Implementation Plans" function aims to set the procedures and actions necessary to accomplish the implementation objectives. It will include a work breakdown structure and a responsibility matrix, where the first downsizes the work into manageable work packages and the later links the activity to be done and the responsible person. In addition, the plans should include expected risks and corrective actions to be taken in case of the plan did not go as planned. Furthermore, the communication plan between the study team has to be developed to portray the reporting structure during the implementation of IPD into the design process in ADFs in Egypt.

6.5.4 Executing implementation plans. Within this function, the plans developed in the previous function will be executed. The execution plans may require that employees involved in the implementation process be trained and equipped with all tools and

technologies required to guarantee the successful execution of plans. In addition, senior management support and offering the required facilities will help achieving the implementation objectives. The execution function should use the work authorisation system, which verifies the predecessor activities and permits the successor activities to proceed. This ensures the quality of work performed. This function will help overcoming some of IPDCs mentioned above such as training architects, enhancing decision-making skills and offering BIM technology to help implementing IPD in ADFs.

6.5.5 Monitoring and evaluating the implementation plans. The aim of this function is to ensure that the implementation of IPD during the design process in ADFs in Egypt goes according to plans. Comments and feedback from the execution team will enable taking corrective actions if plans were not implemented as planned. Furthermore, this will help improving the performance of ADFs in future improvement projects.

6.6 Benefits and limitations of the framework

The benefits of the framework will impact positively on improving the design process in ADFs and the value delivered to the client, as well as the performance of the project at large. The benefits lie in providing ADFs with a practical tool that explains how ADFs can implement IPD in the design process. The IPDIF provides a step by step framework to help ADFs overcome the deficiencies of the traditional procurement approach and overcoming the challenges that encounter IPD implementation. However, the IPDIF's success depends on the encouragement of ADFs and the government to facilitate the implementation process. The application of the framework is time-consuming process which requires full dedication from the participants. Due to the nature of the construction industry and time constraints of projects, this framework may not be welcomed and ADFs may be reluctant to conduct this integration. The absence of governmental legislations and integrated delivery contracts hinder the implementation of IPD in ADFs in Egypt.

7. Conclusion and recommendations

The augmenting recognition of the role played by clients in the construction industry necessitated providing them with sustainable projects that fulfil their needs and meet their expectations at the most cost-effective manner. The design process is one of the most important phases of the construction process because the decisions made during this phase affect the performance of the building throughout its life cycle. The best value for money of projects can be gained through the effective integration, communication and collaboration between the project participants during the design phase. However, the traditional procurement approach which is commonly adopted in the construction industry has proven to contain many flaws and difficulties. This is because it separates design from construction which obstructs the utilisation of knowledge, experience and skills of construction professionals into the design process. The increasing demand for complex and innovative projects as well as the mega projects being developed in Egypt, necessitated adopting new approach that encourages effective collaboration and integration between the project participants. IPD is proposed as a response to overcome the limitations of the traditional procurement approach. Although IPD is being increasingly adopted in the USA and other parts of the world, its application in the Middle East has not begun yet. Despite the numerous advantages that IPD provides, no sign of its implementation can be identified in the Middle East. Moreover, no extensive research was done on this perspective in the region. During this research, literature review was used to identify and categorise the challenges that affect the implementation of IPD in ADFs. In addition, four case studies were used to explore the values that could be delivered or missed to the client upon using IPD or

traditional approaches. Furthermore, results of a survey questionnaire conducted with a representative sample of ADFs in Egypt showed that all respondents are aware of the traditional procurement approach and its advantages and disadvantages. In addition, 83.33% of respondents stated that they are aware of the IPD approach despite it is not being applied in the Egyptian context. Based on the above, the research proposed a framework to facilitate the implementation of IPD in ADFs in Egypt. Accordingly, the research comes to the following recommendations to ADFs and government to address the challenges of IPD implementation:

- Raising the awareness of ADFs and project participants to be open and change their culture towards adopting new approaches such as IPD to improve the performance of construction projects and values delivered to clients.
- Fostering coordination, integration, communication and information flow between project stakeholders during the design process to have a shared vision and maximise the value delivered to clients.
- Providing senior management of ADFs with successful examples of the benefits gained through implementing IPD will help offering the needed resources and allowing the required time for implementation to ensure successful results.
- Providing necessary training programmes, technologies, infrastructure and resources to enhance the technical skills of architects, design managers and other project participants to facilitate the implementation of IPD.
- Encouraging trust, transparency and building long-term relationship between ADFs and project participants to enable sharing information, providing feedback and advice as well as facilitating the adoption of proper decisions for complex and innovative projects.
- Engaging employees in integrating IPD in their ADF' visions, missions and strategies. This will give employees sense of ownership and responsibility.
- Issuing laws, regulations and contracts that encourage the adoption of IPD across the construction industry and regulate the roles of different parties.
- Providing incentives for ADFs that implements IPD and committed to deliver the best value for clients.

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