An Empirical Review of Integrated Project Delivery (IPD) System

Lim Shin Yee, Chai Chang Saar, Aminah Md Yusof, Loo Siaw Chuing, and Heap-Yih Chong

***Abstract*—The demand of industry towards project collaboration and systematic integration had resulted in the development of integrated project delivery (IPD). IPD is served as an innovative project delivery method in the industry which able to improve project performances in terms of time, cost, quality and productivity. However, the awareness and adoption of IPD in construction projects are still below satisfaction level. This paper aims to evaluate IPD integration in construction industry. In order to achieve the aim, the principles, level of IPD integration and barriers are determined to accommodate different industry players. Meta-analysis had been exercised in this study to validate information and to realize the actuality of this study. The IPD principles are re-categorized in accordance to IPD integration level. Besides, IPD implementation barriers are identified. This study is significant for the stakeholders to demonstrate the proactive ways in fostering IPD collaboration; while barriers mitigation and avoidance will maximize the efficiency of IPD in construction projects. This study attempts to develop a conceptual framework of IPD integration in the construction industry.**

***Index Terms*—Integrated project delivery (IPD), IPD principle, integration level, construction industry.**

I. Introduction

Construction industry is one of the fundamentals in global economic which transforms numerous resources into constructed infrastructures to accommodate social economic growth [1]. The continuous advancements of building complexity and specialization, innovation of industry technologies had reflected the inadequacies of conventional project delivery methods. Thus, the demand of systematic integration in construction industry is in prompt and can be initiated from project team integration through IPD [2]. The application of advanced technologies in the industry is posing changes upon project delivery methods [3]; particularly IPD approach for BIM to maximize the effectiveness in projects [4].

IPD focuses on the entire enhancements of the projects by integrating peoples, tools and processes into a system. It possesses high collaborations in integrated multi-disciplinary expertise at the early stage of the project life-cycle to ensure effective design decision is met [5]. IPD approach is introduced to transform the project delivery and management that result in better project performances [6], [7]. The consideration is depending upon if the integration principals are implemented with a new delivery system or under the existing project delivery approaches; however, both are believed to trigger better changes and content with higher investment return [8].

Although the development of IPD is supported by numerous professionals institutes [6], [9], and the benefits had articulated [4], [11], [12], the adoption of IPD in construction industry is dubitable [3]. IPD development in the industry is seen in US, Australia and New Zealand in recent years but the level of knowledge and awareness of construction personnel are limited [13], [14]. Thus, the criteria and level of IPD integration are required to be highlighted to boost the appreciation. Undeniably, the projects which adopted "Pure" IPD and "Actual" IPD are in trivial. This is mainly due to the limited study on the problems and factors affecting IPD implementation in construction industry. This paper aims to evaluate the IPD integration in construction industry. In order to achieve the aim, the IPD principles are re-categorized in accordance with IPD integration level. IPD implementation barriers are identified too. This study is significant for the stakeholders to demonstrate the proactive ways in fostering IPD collaboration; while barriers mitigation and avoidance will maximize the efficiency of IPD in construction projects.

II. Literature Review

A. Principles of IPD

IPD was introduced by America Institute of Architecture (AIA) on 2007. Numerous professional organizations and researchers had discussed the IPD principles as per portrayed from a range of white papers, standards and journals. Project integration mechanisms and the level of collaboration are divided into three groups: contractual, organisational, and technological [15]. While, NASFA *et al.* [6] categorized IPD into IPD catalyst, legal and behaviour principles. These theories are adopted in this paper to refurbish and to realist the IPD principles in Malaysian content. From literature, 21 elements are found and categorized as shown in Table I. There is an additional new principle which with classified the elements into structural principle. This re-categorization met the statement of Sive [3] who indicated that IPD involve: true collaboration (Contractual and Technology), team integration (Behaviour), and streamlined process (Structural).

Contractual or legal principles are the principles related to formal arrangement that will be carried out in IPD projects [15]. These principles are legally bonded and

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should be complied and implemented by projects parties. The multi-party agreement approach will bond project teams contractually and maximize effective project integration through developments of mutual risk and reward system, trust-based relationship contracting and subsequently improve project risk profile [7], [16]. The main projects problems that require to be negotiated in the agreement are risk allocation, percentage of construction contingency, liability limitations, fiscal issues and unused contingency in the projects. Therefore, seven (7) elements are included in contractual principle as shown in Table I.

TABLE I: RE-CATEGORIZED PRINCIPLES OF IPD

Principles	Elements	Sources
Contractual / Legal Principles	Multi-party contract agreement	[3][5][6][19]
	Early involvement of key participants	[3][5][6][9][14] [18][19]
	Shared financial risk and reward / mutual benefits	[3][5][6][9][14] [18][20][21]
	Jointly developed and validated project goals and objectives	[5][6][8][9][14] [18][20][21][22]
	Liability Waivers among Key Participants	[3][5][6][16][18] [20][22]
	Fiscal Transparency (Open book)	[6][14][16]
	Intensified Early Planning	[6][9][14][22]
Behavioural Principles	Mutual respect and trust	[3][6][9][14][21] [23]
	Willing to collaborate	[6]
	Open communication	[6][9][14]
	No blame culture	[21]
	Organisation and leadership	[9][18]
	Unrestricted shared information	[21]
Structural Principles	Lean principle of design, construction, and operation	[6][14]
	Co-location of team	[6][14][21][24]
	Team flexibility	[20][21]
	Operate without boundaries	[21]
	Collaborative innovation	[9][14][21]
	Collaborative Decision-making and control	[5][6][9][14][18] [20][21]
Technological Principles	Appropriate technology	[9]
	Building Information Modelling (BIM) used by multi-party	[6][14]

Team selection is extremely important to guarantee IPD effectiveness. The effectiveness of collaboration is directly influence by members' performances despites the experiences and expertise knowledge [16]. Thus, behaviour of project team will decide upon the integration effectiveness. The word "Behaviour" represents the way a person conducts on oneself, especially the act toward others [17]. In IPD, behavioural principle stands for the informal relationship and programmes to improve the team integration performances, this deal with the mind-set and attitudes of participants [5], [15]. Mitropoulos and Tatum [15] indicated that communication, interpersonal and negotiate skills are important behaviours to influence the effectiveness of team members and performances. In order to achieve the effectiveness of IPD in real practises, these IPD principle elements are need to implement by project teams.

According to Oxford Dictionaries [17], "Structural" is related to the arrangements and relationships between the elements of the whole complex. Structural principle is developed in this study to indicate the arrangement of project team members and their relationships when developing an IPD project team as a whole. Structural principle is the system and process management to manage IPD project. Basically, structural principles may evolve and continually incorporate lessons learned at some points in the projects [18]. The characteristics of structural principle are in the manners of joint responsibility, cooperative decision making and cooperative organisation cultures [15]. Through the definitions, six (6) elements have been classified under structural principle as shown in Table I.

However, the integration among participants does not come automatically. The technology and delivery systems are available, but team members are required to put some efforts on applying those IPD principles as an enabler for great collaborations to unlock the creative potentials of integrated team [8]. Technological principle refers to the use of Information Communication Technology (ICT) as interface tool to improve the project team integration level. AIA [9] stated that appropriate technology is needed to facilitate the integration and collaboration among the different parties in IPD projects. The utilization of appropriate technologies is not limited to integrate different parties but also fostering of sharing information and encourages effective communication such as Building Information Modelling (BIM) [14]. Although IPD can be achieved without the BIM applications, but it is positive that BIM is one of the key factors to accomplish the integration required by IPD effectively [9].

B. IPD Integration Level

In construction industry, determinations should be made between projects to identify whether greater benefits or trade-offs are received from higher level of integration and collaboration [6]. Hence, the baseline of project integration level should be outlined by clients or relevant personnel to ensure an effective IPD. Therefore, it is important to measure the project integration through a systematic measurement. With precise measurements, the collaborative performances can be managed in proactive ways [21]. As indicated by KPMG [16], IPD is not a 'one-size-fit-all' approach; it just merely ought to be taken on in different level of integration after careful consideration. Based on literature, guide for the level of IPD integration is depicted in Table II.

C. Level One Integration – Lean Delivery

Level 1 IPD integration - No contractual is required for the integration among the project participants but depends on the willingness of the participants to collaborate [6]. Typical collaboration is common where many industry players had long practised in certain degree. Integration in this level is very low and insufficient, which possesses less incorporation and limited team sharing; but yet at minimum degree between the collaboration between the clients, consultants and contractors who eventually responsible throughout the entire construction projects [9]. This collaboration relies upon the willingness and commitment of the key participants. This involves trust, reliance, honesty and respect of the participants toward their professionalism and judgments [26]. NASFA *et al.* [6] pinpointed that the critical elements to integration are culture of trust and the willingness of parties to change in collaboration. Behavioural principle is the key aspect required to

implement in this level. This indicates that less degree of IPD integration will not achieve contractual or structural bonding; but simply the behaviours and attitudes to collaborate in order to achieve minor level of integration.

D. Level Two Integration – IPD-ish

Level 2 of integration portrays the implementation of IPD collaboration based on traditional contract formats (without establishes of multi-party contract).In this level, projects are earlier started for sequence designs, formally encourage early production of shop drawings and submittal stages, and incorporate BIM in preconstruction stages [3], [9]. The significant changes into level 2 integrations are shifting of work load and intensify planning to earlier stage of design and construction, and early involvement of key participants(contractor, client and architecture) in early planning and design process [14], [27]. Four major elements to be conducted in IPD-ish are stated in Table II. In this level, clients held the right to make final decisions after the alternatives presented by project participants. Cohen [14] highlighted that project is IPD-ish although the project parties do not shared the risks and rewards. The parties may only concur to limit their liability but do not waive their liability [22].

The aspects of contractual, structural and technological principles are required to be implemented in level 2 in certain level. The contractual principles are highly desirable to be applied in IPD-ish as value added. The elements such as risks and rewards sharing, fiscal transparency and liability waivers are highly recommended in IPD-ish although it does not required to be contractually bonded [6], [14], [22], [27]. As the result, a lot of projects are categorized as IPD-ish even they had incorporated numerous core principle elements in their projects due to lack of multi-party contracts [19].

E. Level Three and Four Integration –"Pure" IPD and "Real" IPD

In level 3 or 4 of integration, projects are contractually bonded on the multi-party contracts and fulfil the requirements of others IPD principles. "Pure" IPD required contractually bonded collaboration, risk and rewards sharing, and access to fiscal information of each party organisation [27]. BIM model serves as a contractual document and will be fully collaborated among the project parties in high level of BIM and IPD integration [28]. BIM tools are required as contractual documents to connect the projects participants legally in Pure IPD [3]. Moreover, Multi-party Agreement (MPA) and Single Purpose Entity (SPE) are available to contractually bond project's parties on Level 3 and 4 integrations.

TABLE II: IPD INTEGRATION LEVEL GUIDE

	Level 1	**Level 2**	**Level 3**	**Level 4**
Integration level	Lowest			Highest
Delivery method	IPD as Philosophy	IPD as Philosophy	IPD as Delivery Method	IPD as Delivery Method
Known as	Lean Delivery	IPD-ish, IPD-Lite, IPD like, Integrated practice	Pure IPD, Relational contracting, Lean Project Delivery	Actual IPD
Nature of Agree-ment	Transacti-onal	Transactional	Relational	Relational
Charac-teristics	No contract-ual language Mutual respect and trust	Some contractual bonded collaboration Early involvement of key participants Co-location of team Intensified early planning / intensified design Lean Principles of design, construction, and operation	Multi-party contract / Single Purpose Entity Collaborat-ion decision making and control BIM implement-ation	Single Purpose Entity Liability Waivers Shared financial risks and rewards Fiscal transpare-ncy Jointly developed and validated project goals and objectives Shared BIM model Team Flexibility
Value Added	Limited risk sharing No blame culture Open Commun-ication	Shared risk and rewards / Mutual benefits BIM used by project participants Less assign liability Unrestricted shared information Fiscal transparency Joint development and validated project goals and objectives Collaborative innovation	Liability Waivers Operation without boundaries Shared BIM model Organisation and Leadership Team Flexibility	

Source: [3] , [6], [9], [14], [18], [19], [21], [22], [25]-[28]

In order to effectively distinguish the ambiguities between IPD level 3 and 4, IPD integration level guide is established as in Table II. In the re-categorized of IPD integration level 3 and 4, projects which applied multi-party contract agreements with parts of IPD contractual principles are categorised as level 3 IPD integration; while the IPD projects that fulfilled all IPD principles contractually and in

Single Purpose Entity are classified as level 4 "Real IPD". This study also classified IPD principles and elements into two groups, which are characteristics and added values elements for the level. Thus, establishment of multi-party contract agreement and collaborative decision-making and control are two main principles which are required to advance IPD integration from level 2 to 3; and the contractual and structural principles are highly recommended to be contractually included in project contracts. IPD projects only classified as level 4 integration when the project team is able to fulfil all IPD principles in all aspects.

Fully integrated team is not the only element that necessary to carry out effective team operation. Baiden *et al.* [21] commented that most construction projects possessing certain level of collaboration to smoothen the project delivery process. Hanna [27] highlighted that IPD is highly encouraged to be implemented in the projects although multi-party contract agreement cannot be used in the projects due to project natures. Highly collaboration environment result in better performances and outcomes even multi-party contract does not applied. Thus, the importance and effectiveness of fully integration should make clear in order to encourage the application of Pure IPD in the future.

TABLE III: CATEGORIZATION OF IPD BARRIERS IN ACCORDANCE TO IPD PRINCIPLES

Barriers	Problems	Sources
Contractual	Lack of "IPD" insurance cover product	[3][5][6][9]
	Build without Guarantee Maximum Prices (GMP)	[6]
	Contract form not tested	[3][6]
	Lack of new legal framework / collaboration model	[9][7][16]
	Risk allocation mechanism	[30]
	Professional Responsibility and Licensing	[9]
	Challenge on selecting compensation /incentive structure	[5][16]
	Dispute resolution	[22]
Behavioural	Resistant to change	[3][6][5][7]
	Lack of confident in project team	[7]
	Lack of IPD awareness	[7]
	Organisation culture	[5][16][30]
	Business risk (return in investment)	[6][7]
	New approach take time	[3]
	Difficult to measure its benefits	[6]
Structural	Front-end investment	[15]
	Project characteristics	[16][30]
	Work process	[30]
	Formation of Entity for "Real" IPD	[9]
	Scheduling issues	[16]
	Surrender command and control	[6]
	Different criteria for procurement	[30]
	Risk issue is new	[6][7]
Technological	IT infrastructure	[7][30]
	Data protocol and copyright	[3][5][22][30]
	Lack of authority to restructure AEC procurement to enable IPD model with advance technologies	[3][7]
	Interoperability	[5][16][30]

F. Barriers of IPD Adoption

The innovative collaboration approaches did associated with problems and issues to the project team itself. In this study, the barriers that affecting industry players from implementing IPD are not restricted for IPD delivery method, but also the barriers to implement IPD-ish in the common project delivery approaches, such as Design and Build. These barriers have been clarified according to IPD principles. The barriers are categorized in four categories: contractual, behavioural, structural, and technological. A total of 27 factors affecting the adoption of IPD have been identified from the literature, and been categorized under four barriers as shown in Table III.

Contractual barrier refers to the problems which will affect the IPD contractual principles. Thus, the factors in contractual barrier are referring to those that able to contractually affect the adoption of IPD in construction project. According to Ghassemi and Bercerik-Gerber [5], the problems of liability and insurances are classified under the aspect of contractual barriers as these problems always contractually bonded and affecting the interests of parties. Hence, eight (8) problems being are categorized under contractual barrier as indicated in Table III.

"Behaviour" is being defined as the way a person behaves under particular situation [31]. Maxfield [32] pinpointed that "behaviour" has a complicated relationship with "culture"; where behaviour is determined by culture, and culture is determined by behaviour. Based on his explanation, a person behaviour is influenced by both personal and environmental (culture) factors, and the inverse will do. Therefore, the behavioural barriers involved the construction company culture and environment factors which may affect the acts and behaviours of the construction personnel. The challenges and barriers of IPD adoption included the unwillingness of changes and mindset of the industry, organisation culture and the traditional hierarchy [5], [16], [21], [33]. The construction parties always resist to adopt new technologies and systems due to the low level awareness on innovation, resistance and scares to change, and low understandings upon the benefits of change. According to these definitions, seven (7) problems are being classified under behavioural principles in Table IV.

By referring to the previous definition of "structural" principle, the structural barrier is directed as the barriers that capable to influence the relationships between the elements or part for the complex whole in an organisation. Moreover, this type of barrier also included the problems that might occur within the construction organisation, project management and operation system when applying IPD. Basically, structural barriers may obstruct the integration in the organisation and project manner even though the contractual barriers tender the integration [15]. Hence, structural barriers involving the benefits and investment of projects, and the management and operation issues regarding to IPD implementation.

Further, according to the Ghassemi and Bercerik-Gerber [5] and Sive [3], the technological barriers can be indicated as the challenges either legally or non-legally occurred on the information ownership, liabilities of parties and the interoperability of the technology used which was first utilised in IPD for better collaboration. Undoubtedly, IT infrastructure is needed in IPD projects, arrangement of data protocol and copyright. The technology interoperability is

the critical problem in technological barriers that needs to be considered when implementing IPD [16], [22], [30]. According to Ciotti *et al.* [22], the protocol and copyright of the drawing and details are required in order to safeguard and protect the liability of project participants. Other than that, Sive [3] highlighted that one of the barriers affecting the utilization of IPD in public institutes and agencies, who are the experts on the other advancements (sustainability and BIM), is lack of influence to reform and fix IPD model in their AEC procurement.

III. Research Methodology

This paper has adopted an evidence-based approach through meta-analysis [34]. Meta-analysis is conducted through systematic review the practices of IPD in journals and white papers in the latest 10 years, as demonstrated in Akobeng [35] and Wai *et al.* [36].

Journals and white papers are collected through several top quality journal publishers and government authorities' institutes, included: i) Science Direct; ii) American Society of Civil Engineering (ASCE); iii) Emerald; iv) Research Gate; v) Range of authorities institutes webpage; and vi) Several online sources. During the selection of journal papers, keywords such as "Integrated Project Delivery (IPD)", "IPD Principle", "Integration Level", "IPD Barriers" are used. In order to retain the validity of analysis, criteria are set where: i) Papers with pre-determined keywords are selected (total 22 journals and white papers that contained keywords in their title); ii) Papers not in the industry field are excluded (one paper is excluded as it is not in construction management context); iii) Papers that were accepted with indexed journal publication only, (one conference proceeding paper is excluded)and iv) Papers within the latest 10 years (two papers are taken out a they had been published for more than 10 years). These criteria are set to strengthen the reliability of this study [10]. Thus, 18 journals and white papers that have been selected for further analysis as listed in appendix (Table IV-Table VI). In these papers, IPD principles are re-categorized through the detail investigation and resources determination. Subsequently, the re-categorized IPD principles elements are being utilised to modify the existing IPD integration level. Moreover, the IPD implementation levels are studied and categorized according to the re-categorized IPD principles. Besides, framework analysis is employed in this study to shift, chart and sort the data according to objectives [39]. Through the familiarization of keywords, the data collected are indexed and charted after identification of thematic framework for this study. Lastly, conceptual framework of IPD principles philosophy affecting IPD integration level and IPD implementation barriers in Malaysia construction industry are developed by interpretation and mapping of data.

IV. Result and Discussion

From the literature, six significances have been identified. They are: collaboration decision making and control; shared risks and rewards; early involvement of key participants; jointly developed and validated goals and objectives; multi-party contract agreement; and liability waivers. These elements are trends to contractual principles and are presented as the necessary key elements to conduct a high-quality IPD project.

Concurrently, several white papers and standard frameworks, such as American Institute of Architecture (AIA) [9], NASFA *et al.* [6], and AIA and AGC [29] also provided exquisite list of IPD principle elements in an equilibrium manner, which parts of the highlighted principles are highlighted in this study too. AIA [9] categorized IPD elements into behavioural, catalysts and contractual principles.

However, the institutes and practitioners researchers are varied when conducting the purpose of researches. The institutes attempted to provide overall IPD philosophy guide for the industry players to better comprehend the purposes and meaning of IPD; while the industry is more concern on the contractual principles in order to integrate different parties together to safeguard organisations' benefits. Besides, elements of multi-party contract and waivers of liability are only been introduced in the later years after several case studies examinations [14]. This indicated that these two elements are important to enhance the contractual bonding and drive IPD projects to perform better. In addition, after the re-categorisation in this study, structural principle has been added in the classification of IPD elements. This is attempted to present a better integral and balanced IPD philosophy, which its characteristics are based on the manners of contractual, participants' behaviour, IPD project structural and technologies. The comparisons are illustrated in Fig. 1.

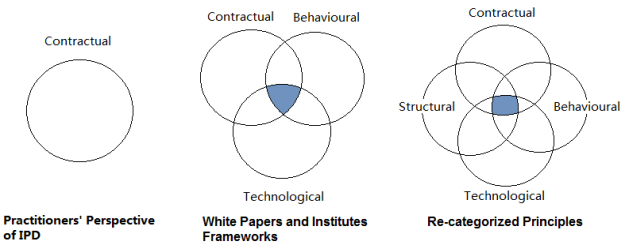

Fig. 1. Comparison of IPD philosophy among practitioners' perspective, white papers and proposed re-categorized principles.

Even though BIM is showing its potentials in assisting IPD performance, its appreciation is still low. The use of BIM in IPD is yet to be justified to become the "must use" element when conducting IPD projects. This may due to the restrictions in BIM system and IPD. Thus, researches and justifications are urgently needed to exemplify the real BIM functions which able to enhance and inter-cooperate with IPD approach.

V. Conceptual Framework

Based on literature, conceptual framework is established for IPD as shown in Fig. 2. This framework is intended to illuminate on the interrelationships of re-categorized integration levels and IPD implementation barriers in corresponding with IPD principles philosophy. The research has emerged in the literature of IPD principles aspect, integration level aspect and implementation barriers aspect.

The details are:

1) IPD principles aspect referred to the 21 elements included in 4 principles in IPD philosophy;
2) IPD integration levels aspect referred to the ability and criteria of construction project in achieving certain level of IPD integration;
3) IPD implementation barriers aspect referred to the categorisation of problems affecting the IPD adoption in construction projects.

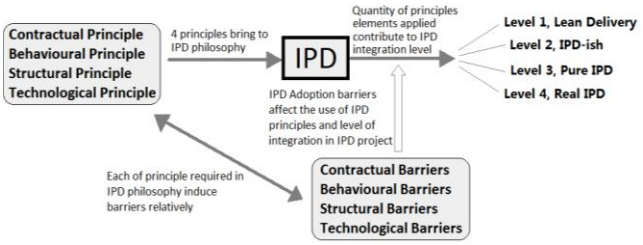

Fig. 2. Conceptual framework for IPD implementation philosophy.

This framework is developed to present range of relationships among IPD principles, IPD integration levels and IPD adoption barriers. In this framework, the actual IPD philosophy is established with the embracement of four principles (contractual, behavioural, structural and technological principles). It should be pinpointed that the number of roofed principles elements applied in the projects posing influence upon the IPD integration levels directly. Besides, the IPD principle elements is the reason why relational barriers are been generated; in which they will affect the implementation of IPD elements in the industry. These barriers subsequently affect IPD project integration level. These interrelationships are decisive to develop and enhance the applicability and functionality of IPD in real practices. The IPD principles conceptual framework will assist construction personnel to better comprehend IPD philosophy and mitigate the possible barriers based on level of IPD implementation. Effective strategic planning and information sharing are the most effective to mitigate housing delay in Malaysia [37]. Therefore, this framework served as a benchmark and baseline, where further explorations and testing can be triggered (in industry or research field) in order to validate the interrelationships of those aspects, subsequently provide inventive procurement approach to mitigate project delay.

VI. Conclusion

The adoption of IPD as a delivery method will bind the project participants to work together and encourage an information-shared environment throughout the entire project delivery process. These contribute in avoidance of the unnecessary waste and low productivity. However, IPD adoption is still limited and the awareness and appreciation of industry personnel are within dissatisfaction level. Therefore, this study focused on conceptualization the IPD principles that are required to apply during an IPD project. Through the use of meta-analysis, four principles (contractual, behavioural, structural, and technological) are re-categorized. By reviewed current situation, practitioners are more concerned on the application of contractual principle. However, it is critical to determine the level of IPD integration. Thus, this paper provides a more integral and balanced view of IPD philosophy and characteristics.

IPD integration level guide has been demonstrated in accordance to IPD principles. The guide illustrated that low level integration tend to be apply of behavioural principles such as willingness to collaborate. As the integration level further heighten, the aspects of contractual and structural principles elements need to be included in the projects, and the principles required more tendencies to be contractually bonded."Real" IPD has been created to better distinguish the level of integration in practical. This study highlighted a number of limitations and predicaments to implicate project integration, and the main reasons is due to the absence of IPD insurance product, lack of new contractual agreement which included all criteria needed for real integration and the need of protocol and copyright to safeguard and protect parties' right and liability.

Through the conceptualization of IPD principles, IPD conceptualized framework is developed in terms of IPD principles, level of integration and implementation barriers. This paper contributed to the body of knowledge by presenting a comprehensive literature about IPD philosophy. The study on IPD principles re-categorization provided improved principles knowledge that is required in performing superior IPD works. This study is significant to propose benchmark of conceptual review in IPD principles for further researches; while it enabled the industry personnel to better appreciate the requirements and relationships of IPD principles implemented in concurrently with level of integration and barriers in order to mitigate the projects delay in Malaysia.

Appendix

TABLE IV: Selected Journals and White Papers for IPD Principles

Re-categorization of IPD Principles			
No	**Source**	**Authors**	**Year**
1	White Paper - American Institute of Architects (AIA)	American Institute of Architects (AIA) and AIA California Council	2007
2	White Paper - American Institute of Architects (AIA)	Cohen J.	2010
3	White Paper - National Association of State Facilities Administrators (NASFA)	NASFA, COAA, APPA, AGC and AIA	2010
4	White Paper – Society for marketing Professional Services Foundation (SMPS)	Sive T	2009
5	White Paper - Australian Construction Industry Forum (ACIF)	Australian Construction Industry Forum (ACIF) and Australasian Procurement and Construction Council (APCC)	2014
6	White Paper - KPMG	KPMG	2013
7	White Paper – Hanson Bridgett	Ashcraft H.W.	2013
8	CMAA Book Chapter	Darrington J, Dunne D. and Lichtig W.	2009
9	International Journal of Project Management	Baiden B.K., Price A.D.F., and Daity A.R.J	2006
10	CIM Construction Journal	Ciotti R.D., Hinckley A. S.,	2011

		Pasakarnis S.M.	
11	Technovation	Lakemond N. and Berggren C.	2006
12	Journal of Construction Engineering and Management	Asmar, M. E., Hanna, A. S., &Loh, W. Y.	2013
13	Lean Construction Journal	Ghassemi and Becerik-Gerber	2011

TABLE V: SELECTED JOURNALS AND WHITE PAPERS FOR LEVEL OF IPD INTEGRATION

Level of IPD Integration			
No.	**Source**	**Authors**	**Year**
1	White Paper - National Association of State Facilities Administrators (NASFA)	NASFA, COAA, APPA, AGC and AIA	2010
2	White Paper - American Institute of Architects (AIA)	American Institute of Architects (AIA) and AIA California Council	2007
3	White Paper - American Institute of Architects (AIA)	Cohen J.	2010
4	White Paper – Hanson Bridgett	Ashcraft H.W.	2013
5	White Paper – Society for marketing Professional Services Foundation (SMPS)	Sive T.	2009
6	CIM Construction Journal	Ciotti R.D., Hinckley A. S., Pasakarnis S.M.	2011
7	Journal of Construction Engineering and Management	Asmar, M. E., Hanna, A. S., &Loh, W. Y.	2013
8	International Journal of Project Management	Baiden B.K., Price A.D.F., and Daity A.R.J	2006
9	Structures Congress	Lancaster F. D. and Tobin J.	2010
10	Journal of Construction Engineering and Management	Hanna A. S.	2016

TABLE IV: SELECTED JOURNALS AND WHITE PAPERS FOR IPD BARRIERS

Barriers of IPD			
No.	**Source**	**Authors**	**Year**
1	White Paper – Society for marketing Professional Services Foundation (SMPS)	Sive T.	2009
2	White Paper - National Association of State Facilities Administrators (NASFA)	NASFA, COAA, APPA, AGC and AIA	2010
3	White Paper - American Institute of Architects (AIA)	American Institute of Architects (AIA) and AIA California Council	2007
4	White Paper - KPMG	KPMG	2013
5	Lean Construction Journal	Ghassemi and Becerik-Gerber	2011
6	Journal of Construction Engineering and Management	Kent D. C. and Becerik-Gerber B.	2010
7	Procedia Engineering	Azhar N., Kang Y. and Ahmad I. U.	2014
8	CIM Construction Journal	Ciotti R.D., Hinckley A. S., Pasakarnis S.M.	2011
9	International Journal of Project Management	Baiden B.K., Price A.D.F., and Daity A.R.J	2006

*National Association of State Facilities Administrators (NASFA), Construction Owners Association of America (COAA). The Association of Higher Education Facilities Officers (APPA), Associated General Contractors of America (AGC), American Institute of Architects (AIA)

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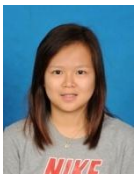

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