

THE ADOPTION OF INTEGRATED PROJECT DELIVERY IN PUBLIC SECTOR PROJECTS IN NEW ZEALAND: THE WAY FORWARD

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ABSTRACT

The construction industry in New Zealand is responsible for around 40% natural resources, 30% energy consumption, and 30% greenhouse gases. The increased costs in natural resources, and energy, together with environmental concerns have pushed the demand for green buildings. Integrated Project Delivery (IPD) process has emerged as an enabler for green buildings. Successful IPD combines the partnering concept and lean thinking, it addresses the participant's expectations, cuts costs, eliminates waste, reduces variability and generates value for all the participants. Yet many public sectors owners, do not have the authority to adopt features of IPD. However, owners can benefit from the IPD philosophy and features to take advantage of some key benefits. The purpose of paper is to examine the IPD tools and techniques appropriate for public sector organizations in New Zealand and to examine the barriers that public sectors organizations face in New Zealand while adopting those IPD features. A pilot study was conducted to examine these issues, semi structured interview were carried out with four public sector construction industry specialists. The interviews revealed that there is a gap between current and best practice in the New Zealand construction industry that is impacting on the adoption of IPD or IPD approaches. To improve the delivery of public sector projects a checklist of specific IPD tools and techniques appropriate for NZ public sector projects has been developed.

Keywords: *Integrated Project Delivery; IPD; Public Sector, Construction Industry.*

1. INTRODUCTION

The construction industry in New Zealand is responsible for around 40% natural resources, 30% energy consumption, and 30% greenhouse gases (Forsyth *et al.*, 2014). The increased costs in natural resources, and energy, together with environmental concerns have pushed the demand for green buildings. Integrated Project Delivery (IPD) process has emerged as an enabler for green buildings. Successful IPD combines the partnering concept and lean thinking, it addresses the participant's expectations, cuts costs, eliminates waste, reduces variability and generates value for all the participants. Yet many public sectors owners, do not have the authority to adopt features of IPD. However, owners can benefit from the IPD philosophy, its features and its key benefits.

The paper begins by exploring the nature of IPD, its key principles, the benefits of its implementation and the factors that are driving its adoption in construction industry, to provide a theoretical base for the study. This informs the research objectives, which suggested certain methodological constraints and avenues for the investigation. The results are summarised and discussed, a conclusion and suggestions for further research is also provided.

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2. LITERATURE REVIEW

2.1. THE DRIVERS OF IPD

The fragmented nature of the construction industry, particularly the separation between the design and construction, the uniqueness and complicated nature of building projects places great responsibility on the project team in setting up a comprehensive building process and successfully concluding a project (Sidwell, 1982). One fundamental aspect of the building process that requires particular and early attention is the selection of the most suitable organization for the design and construction of the project if success is to be achieved (Masterman *et al.*, 2003).

There are several limitations to traditional project delivery methods used in construction industry (Strickland, 2010). Over the years, construction project delivery methods have been evolving continuously (Kent and Becerik-Gerber, 2010). With time projects have become more complex in nature due to higher expectations of clients, advancement in technology, need for sustainability and energy efficiency (Kent and Becerik-Gerber, 2010). Clients have also become more aware of waste and productivity issues, technological advancements and are demanding change, it is suggested that the goal of everyone in the construction industry should be faster, better, more capable project delivery created by fully integrated, collaborative teams (NASFA *et al.*, 2010).

IPD has emerged in response to this need (Nofera *et al.*, 2011) and to reduce inefficiencies that are a part of current design and construction practices (Kent and Becerik-Gerber, 2010). Frust (2010) stated that Integrated Project Delivery (IPD) process offers a way to organize the delivery of construction projects that uses the partnering concept and lean thinking, addresses participant's expectations, cuts costs, eliminates waste, reduces variability and generates value for all the participants through the procurement, design and construction process. IPD as a process embodies the principles of concurrent engineering. Anumba *et al.*, (2002) stated that concurrent engineering facilitates the simultaneous consideration of all project-related issues and processes from the conception stage. Concurrent engineering uses systematic or parallel processes (rather than traditional sequential ones), and multi-disciplinary teams comprising all parties involved in the project, including the client and suppliers (Evbuomwan and Anumba, 1998). It seeks to improve project outcomes by using a collaborative approach to align the goals and incentives of project team through early involvement of all parties, shared risk and reward, and a multiparty agreement (Kent and Becerik-Gerber, 2010). The principles of IPD can be applied to a variety of contractual arrangements and requires highly effective collaboration between the client, designer and contractor, from the early design phase through to project handover (Azhar *et al.*, 2014). Usually, IPD teams include members beyond the basic triad of client, designer and contractor (AIA 2007a).

Waste and lack of productivity are also considered as an important driver of IPD. A Lean Construction Institute study (2004) suggests that as much as 57% of effort, time and material investment does not add value to the final product in construction projects, as compared to 26% in manufacturing industry (NASFA *et al.*, 2010). It is suggested that to reduce this waste there is a need for change in the environment in which project teams are appointed and perform; and collaborative environments where all team members contribute to problem solving are required (ACIF *et al.*, 2014). Perhaps this is why the biggest support for IPD is from within the Architecture/ Engineering/ Construction (A/E/C) industry that shares the owner's frustration about cost overruns, lack of coordination, change orders, poor communication and missed information (Sive, 2009).

IPD has the potential to revolutionize the construction industry as it focuses on overall improvement by integrating tools, processes and people into a system (Azhar *et al.*, 2014). Several professional organizations support the advancement of IPD, however a relatively small number of projects are using IPD (Ghessemi and Becerick-Gerber, 2011; Kent and Becerik-Gerber, 2010; Sive, 2009).

2.2. BENEFITS OF IPD

Mihic *et al.* (2014) stated that, "IPD leverages early contributions of expertise and knowledge through utilization of new technology, allowing all team members to better realize their highest potential while expanding the value they provide throughout project life cycle." Building upon early contributions of

individual expertise, these teams are guided by principles of trust, transparent processes, effective collaboration, open information sharing, team success tied to project success, sharing risk and reward, value-based decision making and utilization of full technological capabilities and support (AIA, 2007b). The outcome is the opportunity to design, build and operate as efficiently as possible (Mihic *et al.*, 2014).

According to AIA (2014), IPD is the key for proper consideration of many features, criteria and constraints of final design from the conceptual stage. Jones (2014) expressed that it offers a solution oriented approach as the planning is done at an early stage by a relevant and specialist team. Here the key participants work collaboratively on first defining the project goals and objectives including cost, time, quality and sustainability, and then analysing the satisfaction of the objectives through the use of local resources, opportunities presented by the site and selection of proper materials (Cleves and Gallo, 2012). In this kind of collaborative design environment, supported by responsive decision analysis tools, the possibilities of refining the design are wide- ranging (Jones, 2014). It is suggested that this leads to a high degree of confidence in the design in terms of component and material efficiencies; cost and time objectives and sustainability (Jones, 2014). Also, continuous efforts are made to reduce waste; use economical and environmentally sustainable materials; improve health and safety and reduce pollutant generation (Smith *et al.*, 2011).

2.3. BARRIERS TO IPD

The project team and its members are the centre piece of integrated project delivery (AIA, 2007b). However, IPD presents challenges for the project team (Ghessemi *et al.*, 2011). The implementation of IPD is not easy, especially in public sector projects (Azhar *et al.*, 2014). According to Kent and Becerik-Gerber (2010), while new contract documents supporting IPD exists, they have not been tested properly and are not fully proven or understood. Construction industry firms are accustomed to traditional ways of responsibility, leadership and opportunity; and change is slow. Barriers faced by public sector organizations to implementing IPD can be categorized as legal and contractual barriers; cultural and organizational barriers; and technological barriers (Azhar *et al.*, 2014; Ghessemi *et al.*, 2011).

Legal and Contractual Barriers

Legal and contractual barriers refer to issues of risk allocation, liability and insurance (Ghassemi *et al.*, 2011; Kent and Becerik-Gerber, 2010). Some IPD contracts reduce or eliminate the ability of parties to sue one another for better collaboration, but the current insurance products are designed to assign liability to each participant, and this makes the contractual arrangements more complicated (Cohen, 2010; Sive, 2009). According to Azhar *et al.*, (2014) typically for public projects, architectural and engineering services are procured through negotiated contracts as a part of quality-based selection, whereas contractors are selected through open competition and lowest responsible bid (Ghassemi *et al.*, 2011). In this kind of procurement selection, design is completed before involvement of the contractor in the process and this inhibits key aspects of IPD including multiparty agreements, shared risk and reward and early involvement of all key participants (Azhar *et al.*, 2014).

Cultural and Organizational Barriers

Cultural and organizational barriers within the construction industry refer to resistance to change; lack of leadership; lack of a widely accepted solution; size of project and type of project (Azhar *et al.*, 2014; Eadie *et al.*, 2007). Since IPD projects require significant additional costs and design efforts, some critics believe that IPD should be reserved for large and complex projects (Tucker *et al.*, 2013; Lichtig, 2005). Others believe that IPD is more beneficial in repetitive facilities rather than unique one-time projects (Cleves *et al.*, 2012). Lichtig (2006) expressed that the real challenge is to overcome the inertia and change the mindset built on traditional practices. Organizations are accustomed to 'tried and tested' methods and they show resistance to change, which can be aggravated by lack of awareness of new processes; improper communication and information transfer; and concern related to liability and risk in new processes (Zipf, 2000).

Technological Barriers

Technological barriers can cause concern while implementing IPD and are related to legal challenges of ownership, interoperability concerns and liability in the integrated use of technology (Ghessemi *et al.*,

2011; Kent and Becerik-Gerber, 2010). It is essential to establish information management protocols from the beginning that include ownership information, format of representation, responsibility, access and accountability in respect to project information (Azhar *et al.*, 2014) Availability of adequate IT infrastructure is not mandatory for IPD implementation, but experts strongly believe that it is necessary for the level of integration and collaboration required for IPD projects (Eastman *et al.*, 2011). Since, different organizations use different IT systems, interoperability issues arise when these organizations form a project team (Moses *et al.*, 2008). Some other barriers, according to Eadie *et al.* (2007) are high costs of IT systems, lack of technical expertise, IT security issues and in some cases, no business benefit being directly realized.

2.4. IPD IN NEW ZEALAND

The New Zealand government has set a target to improve construction sector productivity by 20% from year 2010 to 2020 (Fuemana *et al.*, 2013). Gillies (2013) expressed that the government seems to recognize this to some extent and proposes IPD, but it is unclear how it might be recorded in a contract and what it would actually mean in practice. A report by New Zealand Productivity Commission (2012) noted that project delivery issues in New Zealand's construction industry could be minimized through better upfront planning and greater collaboration between clients, builders, designers and sub-trades, and suggested adoption of IPD to better facilitate project delivery. However According to Ryan *et al.* (2013) the New Zealand construction industry is not completely familiar with IPD.

This paper aims to investigate the following issues for public sector organizations in New Zealand:-

1. Identify in what form, if any, IPD is being utilized in the New Zealand Construction Industry.
2. Investigate the barriers that are faced by public sector organizations when employing IPD.
3. Examine the IPD tools and techniques applicable for public sector construction projects in New Zealand.

3. METHOD

The purpose of the research was to gain deep insights into the elements of IPD and the reality of its uptake. The nature of the research problem meant that an inductive approach was appropriate. This was exploratory in nature and a qualitative approach was taken as this would help to develop knowledge and understanding.

The sample size is limited and focuses on exclusivity of text and that the focus of the research should be transferability rather than generalizability (Marsh and White, 2006). Four construction industry specialists took part in the pilot study. The sample was selected based on the industry specialists experience in terms of their professional role, nature of work and projects they had undertaken in the construction industry. All of the industry specialists were all working for or closely with public sector organizations in New Zealand to deliver construction projects and had participated in at least 2 or more public sector construction projects in New Zealand. They were identified through personal networking, social media and company websites and selected on the basis of a homogeneous purposeful sampling technique (Patton, 1990) this ensured that all participants were selected based on specific criteria. A brief summary of each construction industry specialist is outlined below (see Table 1).

Table 1: Demographic Information of Participants

Interviewee	Role in Construction Industry	Years of Experience in role	Years of experience in Construction Industry	Level of Academic Qualification
1	Architect (Private Consultancy)	7	12	Bachelors of Architectural Studies
2	Project Manager (Contractor)	3	8	Graduate Diploma in Construction Management
3	Project Manager (Local Council)	9	25	Bachelors of Engineering
4	Project Director (Private Consultancy)	16	36	Bachelors of Engineering

As the interviews were semi-structured they were neither a completely open conversation nor were they highly structured (Kvale, 1996). Semi structured interviews were conducted, it is well suited for exploration of opinions and perceptions of respondents regarding complex and sometimes sensitive issues, and also enable probing for more information and clarification of answers (Barriball and White, 1994). The interviews followed suggested themes and questions which were formed from the literature. Face to face interviews were conducted lasting approximately 30 minutes in duration, this method was preferred over other formats because it generates a more effective interaction and motivates the participants to spend more time and put in extra effort (Ramanayaka, 2013). Notes were taken by the interviewer during the interview.

The interview data was analysed using content analysis as it allows the researcher to make valid inferences from the data to the context with the aim to provide new knowledge, insights and facts that can be tested at a future date (Krippendorff, 1980; Elo and Kynga, 2008). The analysis allowed the commonalities and differences that existed between each interviewee to emerge. The dominant themes are summarised below.

4. FINDINGS AND DISCUSSION

Based on the interpretation of the data the findings can be categorized into a number of themes including the definition of IPD, benefits of IPD, type of projects most appropriate for IPD implementation and the potential barriers to IPD implementation in New Zealand's public sector construction projects.

A general understanding of IPD was communicated, the participants confirmed that IPD is a project delivery method where clients, contractors, designers and consultants work collaboratively as an integrated team, with their commercial interests aligned with actual project outcomes.

All the participants appreciated the intent of IPD, they believed that the IPD framework helps in establishing right relationships among project participants to achieve success, especially in complex and large-scale projects. A general consensus among the participants related to the benefits associated with the use of IPD or IPD type delivery which supports the work of Azhar *et al.* (2014). They stated that companies can improve their competitive positions, gain entry into new markets, supplement critical skills and share the risk and cost of major developments which is in line with the AIA findings (AIA, 2007b).

The information collected from interviews revealed that IPD or IPD type delivery is particularly suitable for projects that are: large, complex and high cost; need high flexibility; face significant or undefined risks; have scope for innovation; have a tight time schedule to carry out; and involve significant stakeholder, environmental and/or political implications. The participants' views support the literature and suggest that IPD is suitable for large and complex projects that require flexibility, enhanced communication, innovation, enhanced quality and effective risk management (Frust, 2010; Azhar *et al.*, 2014).

The participants suggested that the IPD approach can be fundamental in achieving target outcomes and sharing risk for high profile public sector projects. They also expressed that public sector organizations in

New Zealand are increasing their use of IPD type delivery for construction projects methods similar to IPD are also being utilized on large infrastructure, public sector projects including 'Project Alliancing' and Design and Build project delivery with increased collaboration and integration. Public sector organizations are also adopting collaborative and integrated practices like early involvement of participants, shared risk and reward, organizing workshops with stakeholder involvement and no litigation.

The participants went on to confirm that the adoption of IPD can immensely benefit and transform the construction industry in New Zealand from a traditional 'best for organization' practice to 'best for project' practice (Azhar *et al.*, 2014). Also, since public sector organizations are the largest procurers of construction in New Zealand, the adoption of IPD approaches could transform the practices throughout the industry, especially in large private organizations that work closely with public sector organizations, which in New Zealand's case is true for most large private sector organizations.

The participants revealed that there is a gap between current and best practices in the New Zealand construction industry that is impacting the adoption of IPD or IPD type approaches. A wide range of barriers to IPD were discussed and support the literature presented. Legal and contractual issues were raised by the participants. For the adoption of IPD in particular, there is a lack of suitable form of contract in New Zealand that is consistent with both IPD methodology and the Construction Contracts Act 2002. This supports the work of Cohen (2010) and Siva (2009) who confirmed a lack of proper contract form as an important barrier to IPD implementation. The New Engineering Contract x12 was suggested a solution for this by one of the participants as it is specifically designed for multi-party agreements. Other contractual challenges that could be faced while implementing IPD in New Zealand's public sector construction projects include lack of insurance policies and bonding arrangements; complications with job costing and accounting; assigning project leadership; and deciding framework for contractual renegotiations.

Cultural and organizational barriers discussed by the participants included: resistance to change, lack of leadership and uncertainty of risk involved (Azhar *et al.*, 2014; Eadie *et al.*, 2007). Participants suggested that one of the most significant challenges to IPD suggested is the client's resistance to change, primarily due to lack of knowledge and experienced personnel that could lead the change in their organization. Participants also confirmed the challenging cultural paradigms that exist in the construction industry which can act as a barrier to the successful implementation of IPD on public sector construction projects (Lichtig, 2006; Zipf, 2000).

Another factor that demotivates the clients from spending resources on IPD developments is the uncertainty of risk involved in multi-party contracts and collaborative arrangements where the client loses a degree of control in decision-making. The issue of risk allocation which supports the work of (Ghassemi *et al.*, 2011; Kent and Becerik-Gerber, 2010).

A further barrier to IPD is that of other key project participants, who traditionally have an adversarial 'control-based' approach to contract management, and changing this behaviour and attitude of people in the construction industry towards 'trust-based approach' is also a key issue.

Participants confirmed technological barriers to the implementation of IPD. They stated that the availability of adequate IT infrastructure is critical for the level of integration and collaboration required during implementation of IPD, especially on large and complex public sector projects this supports the work of Eastman *et al.* (2008). Although large organizations in New Zealand can deliver on the IT infrastructure requirements for IPD implementation, small and medium enterprises that play crucial roles as sub-contractors and suppliers for public sector projects are still lagging behind in their technological capabilities. Some of the reasons identified for this lack of technological capabilities among small and medium enterprises are high upfront and maintenance cost of technological developments; lack of trained professionals and lack of awareness of how technological advancements will impact these firms (Ghessemi *et al.*, 2011; Kent and Becerik-Gerber, 2010; Eadie *et al.*, 2007). Participants also raised concerns over the interoperability issues since different organizations involved in a project can have different type and level of complexity of technology available to them which supports the work of Moses *et al.*, (2008).

The findings also support the suggestions that, project delivery issues in New Zealand public sector construction can be minimized by using IPD which can offer better upfront planning, collaboration and integration. Public sector organizations in New Zealand recognize this and are adopting project delivery tools and techniques that are quite similar to IPD (New Zealand Productivity Commission, 2012).

The third and final objective of the paper is creating a list of IPD tools and techniques that are appropriate for implemented on public sector construction projects in New Zealand. Table 2 demonstrates the IPD tools and techniques, with their benefits, which could be adopted for delivery of public sector construction projects in New Zealand. The recommendation for adoption of these tools and techniques is based on the synthesis of the literature and analysis of the data.

Table 2: IPD Tools and Techniques appropriate for NZ Public Sector Projects

IPD Tool or Technique	Benefits
Multi-party Agreement	Maximizes collaboration, builds trust, single point of responsibility on project team
Shared Risk & Reward	Confidence to project participants, best for project attitude, promotes innovation
Early involvement of all parties	Minimize fragmentation, improved and informed decisions during design phase, optimize the whole project
Integrated Teams	No blame culture, high performance, continuous improvement, flexibility, optimize the whole project, enhanced communication
Integrated Governance	Collaborative and innovative decision making, flexibility, mutual trust and respect, optimize the whole project
Transparency	Mutual trust and respect, accurate information for all participants, prevents contingency hiding
Contingency Pool	Safety for project participants, encourages teamwork, prevents contingency stacking
Lean Construction	Maximize efficiency, minimize waste, value for client, promotes sustainability
Incentive Pool	Promotes high performance
Building Information Modelling (BI M)	Easy access to project information for all participants, current and accurate information for all participants, process quality, increased productivity, better collaboration and information sharing

According to the literature review, multi-party agreements are a key aspect of IPD. Even though there is no specific contract form for IPD in NZ, the qualitative analysis revealed that the New Engineering Contract x12 is designed specifically for multi-party agreements and can be used by public sector organizations in NZ. Therefore, multi-party agreements could be adopted by public sector organizations while implementing IPD or IPD type project delivery.

Both, literature review and qualitative analysis revealed that public sector organizations are already adopting techniques including early involvement of all parties and shared risk and reward due to various benefits offered by both these techniques, therefore, both these techniques should also be adopted for IPD or IPD type delivery. To successfully deliver a project that contains tools and techniques like multi-party agreement, shared risk and reward, and early involvement of all parties, it is important to formulate integrated teams and practice integrated governance to ensure success (AIA, 2007b; Mihic *et al.*, 2014). Transparency is essential to build trust in a collaborative and integrated setting and a contingency pool provides safety for project participants that in turn motivates the project participants and prevents contingency stacking. An incentive pool is another tool that motivates the project participants to perform better and has proved to be quite beneficial in IPD or IPD delivery. Finally, lean construction and BIM are two features of IPD whose importance cannot be stressed enough in delivering large and complex public sector construction projects in NZ.

5. CONCLUSIONS

The importance of the right project delivery system in a construction project cannot be overstressed, but historically, very few attempts have been made to improve these systems. IPD is an attempt at improving project delivery, and as this paper has examined how the implementation of IPD can successfully improve public construction project delivery and add value to projects and organizations involved.

These exploratory findings are consistent with the literature regarding the fundamental features of IPD, the level of uptake of IPD in New Zealand, as well as the barriers and benefits of IPD for Public Sector Construction Projects. In summary the benefits of IPD for Public Sector Projects in the New Zealand Construction industry include that IPD is suitable for large and complex projects that require flexibility, enhanced communication, innovation, enhanced quality and effective risk management and project delivery issues in New Zealand public sector construction can be minimized by using IPD which can offer better upfront planning, collaboration and integration. In contrast there a wide number of barriers to the implementation IPD for Public Sector Projects in the New Zealand Construction industry. These include legal and contractual issues, cultural and organizational and technological constraints. The most appropriate IPD tools to encourage IPD implementation on Public Sector projects in New Zealand are the use of multi part agreements, a system that accommodates shared risk and reward, facilitates integrated team and governance and champions' transparency throughout the project.

Given that the study is based on a small number of industry expert opinions, it would be useful to conduct a more in depth study focusing on the key results presented. One specific area that a wider study should focus on is the relationship between IPD and Building Information Modeling (BIM). BIM offers easy access to project information, current and accurate information for all participants. It also offers process quality, increased productivity, better collaboration and information sharing and has the potential to improve the uptake of IPD. The research provides insights into IPD uptake and barriers to IPD for public sector projects in the New Zealand context. This is a pilot study and the results should be used cautiously as they are not generalizable due to the small sample size. However they are transferable and these findings could form part of a wider study. This would contribute to the exploration of a well refined and calibrated IPD decision making tool for construction project owners. For this to occur a detailed statistical analysis of the cost and benefit of implementing IPD on public sector construction projects in NZ is needed as well as further validation of the findings presented in this paper.

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