

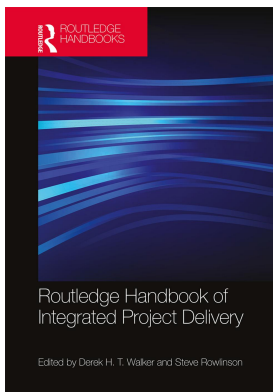
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Derek H. T. Walker, Steve Rowlinson

The global state of play of IPD

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THE GLOBAL STATE OF PLAY OF IPD

Derek H. T. Walker and Steve Rowlinson

Introduction

This chapter concentrates on various global integrated project delivery (IPD) forms known to us at the time of writing this book. IPD forms evolve, and as we saw in Chapter 2 in the application of the *Collaboration Framework* as a procurement strategy design tool, a very wide range of collaborative integrated project delivery (IPD) forms may be ‘created’ to suit particular purposes. This chapter builds on Chapter 1 Table 1.2 that contrasted ten characteristics of IPD with non-IPD forms to provide a more extensive description of IPD forms from the perspective of how they have evolved and are evolving in a number of selected countries across the globe. In this way we intend to provide readers with a well-informed global sense of where this field is heading and how and why that trajectory is occurring.

The two main questions explored in this chapter are:

- 1 To what extent is IPD and alliancing being adopted and adapted globally?
- 2 What is influencing its adoption and/or adaptation?

The chapter begins with a brief explanation of what *relational* means with respect to IPD-alliancing. This is followed by a section that closely examines project delivery from an integration and relationship perspective so that IPD forms may be mapped within a range of integrated relationship delivery forms. This leads to a section that outlines the global state of play towards the end of the 2010s period followed by discussion of why IPD has been embraced more readily in some countries and/or regions than others. Finally we summarise the chapter.

What do we mean by relational?

IPD forms are highly relational in their core values. This term ‘relational’ needs a little more explanation to precisely understand its foundational principles. It is important to avoid confusing IPD with other project delivery forms that embrace coordination of separate disciplinary teams seen in many traditional project delivery forms, such as variants of the integrated design and build/construct (D&C) approach. This begs a question about the extent to which intensity of relational project delivery forms impact project outcomes (rather than output as specified). The client

(project owner) may get what was asked for but not what was needed to be delivered. This implies that the process of scoping and requirements specification may be deficient in most current forms of project delivery. Additionally, we may question how various forms of project delivery have evolved out of the Build Own Operate Transfer (BOOT), Private Finance Initiative (PFI) and Turnkey forms to be more broadly known these days as public–private partnerships (PPP). Are PPPs genuine IPD forms? What about joint ventures between contractors delivering projects – are these genuine IPD forms as well?

Project delivery choices and their rationale have been studied for decades. During the early 1990s the International Council for Building, formally known as the ‘Conseil International du Bâtiment’ (CIB)¹ commissioned the working group W092 on construction procurement with Steve Rowlinson as co-coordinator. It held its first conference in Zagreb, Croatia in 1990. One of the more important outcomes from that conference working group meeting was a book (Rowlinson and McDermott, 1999) that outlined various project procurement forms as well as other chapters that expanded on the rationale for various project delivery forms. Earlier in that decade, another seminal construction-oriented project procurement book had been published that was dedicated to the topic of procurement (Masterman, 1992) that has been updated (for example in edition 2 of Masterman, 2002). Other publications that trace an interest in project procurement were short report-style books published through professional associations (Franks, 1984; Nahapiet and Nahapiet, 1985). Chapters or sections in books on procurement have been evident in the construction management literature since the early-mid-1990s (Walker, 1993; Harris and McCaffer, 1995; McGeorge and Palmer, 1997) with many of this era of books updated with editions running to edition 7 for example in Harris and McCaffer (2013) and edition 6 for Walker (2015). Much of the earlier discussion on procurement systems related to traditional approaches assuming that the client hired a design leader as project superintendent with some options that comprised forms of design and construct. Additionally, this literature had a high focus on contract forms and conditions, particularly risk and design change management, rather than relationships between participants. However, recognition of the advantages of ‘buildability’ or ‘constructability’ had been evident from a study into partnering undertaken by the Construction Industry Institute (CII, 1996) that stimulated interest in the advantages of relationships between project delivery participants (Testi, Sidwell and Lenard, 1995; Sidwell and Mehertns, 1996; Walker and Sidwell, 1996).

If relationship-based project procurement and delivery is not a new concept, how did it evolve into a project delivery context and how is it changing? One of the seminal authorities on relational contract theory is Macneil (1978; 1985). He was an early thinker who made significant theoretical advances on the nature of transactions between people and business entities beyond the immediacy of a discrete short-term transaction to buy something. However, we also need to acknowledge related interdependence in decision-making, uncertainty and contingency theory work undertaken by the Tavistock Institute. Examples include Cartwright and Zander’s (1960) early work on group dynamics and Burns and Stalker’s (1961) ground-breaking innovation theory development. Macneil was interested in the nature of the relationship between people and business entities when the purchase transaction is centred on a complex system of components such as a building or infrastructure, e.g. a rail line, roadway, airport or hospital. A number of scholars have applied these ideas in a construction–project delivery context to explain the role of behaviours of parties undertaking business transactions while jointly delivering a project. Memon (2017, Section 2.2) provides a well-articulated explanation of the origins and significance of relational contracting theory. The main point to be taken from the relational contracting literature is that for complicated or complex projects, such as building an underground railway or facilities on brownfield site locations, the primary focus is on the quality of the relationship between the client, design team, contracting parties and other relevant external

stakeholders that enables them to collaborate to coherently deliver value through the project and not just to focus on the content of contractual terms.

Until recently, scholars and practitioners looked at construction–project delivery from a product rather than service perspective. The reconceptualisation of the purpose of project delivery, particularly in construction, has taken a ‘value’ turn. This adopts a new direction in marketing. The intended deliverable moves from an output to an outcome in what is often referred to as taking a service rather than production–logic perspective (Grönroos, 1990; Grönroos, 2011). The traditional project delivery focus has been on contract forms to deliver a product outcome such as a building, an infrastructure facility (such as road or rail). Performance metrics tended to revolve around the ‘iron triangle’ delivery of cost and time and quality in terms of fitness for purpose (Atkinson, 1999; Andersen, 2008). The perspective focused on what these types of project delivery outcome provided rather than looking at what was intended to be achieved through the procurement process delivering the project. This has radically changed the way that we perceive project delivery. The goal of more relational type delivery forms focuses on project outcome, and the value or benefit it generates by moving beyond the iron triangle (Andersen, 2008; Bradley, 2010; Toor and Ogunlana, 2010; Zwikael, 2016). At the same time, groups such as W092 have collectively shaped the delivery process focus over recent decades away from just ‘getting the job done’ to one of satisfying influential and other valid stakeholder needs and concerns (Engwall, 2003; Eskerod, Huemann and Savage, 2015), conducting the project ethically (Helgadóttir, 2008; Bredillet, 2014; Lloyd-Walker and Walker, 2017) and considering organisational learning and innovation as an important and valued project deliverable (Davies, MacAulay, DeBarro and Thurston, 2014; Love, Teo, Davidson, Cumming and Morrison, 2016).

Taking an integration and relationship perspective on project delivery

There is no shortage of literature that describes various forms of project procurement and delivery and this goes some way to explain varying levels of integration between the main participants: the project owner (PO) or owner participant (OP) representative; the design team; and contractors and suppliers delivering the project. Sidwell (1982), Rowlinson (1988) and Ireland (1983) in their PhDs produced seminal work that linked the organisational form of different procurement systems to performance and client criteria. From this work, subsequent authors developed these typologies further. The main contribution of their work was to bring general management theory into the construction project–management field. In doing so, they brought to the attention of construction management researchers the concepts of integration, differentiation, performance measurement and contingency views. Indeed, they built on the work of the Tavistock Institute, Mintzberg (1979), Woodward (1958) and others in broadening the scope of research into construction management and particularly procurement systems.

Early text books such as Masterman (1992) had built upon research undertaken by various scholars engaged in the Organising and Managing Construction, CIB W-65 workgroup with Rowlinson during the mid-to-late-1980s, that later developed into the CIB working group W092. These W092 researchers are often cited by scholars drawing upon that seminal work. Masterman (1992) discusses relational forms of procurement in terms of separated, integrated, management-oriented and discretionary procurement systems. Other scholars and organisations have also described and detailed project delivery forms that have developed since Masterman’s (1992) seminal work. Table 3.1 summarises various project delivery forms from the integration and relationship intensity perspective. Naturally, individual projects will vary from this ‘norm’ depending on the personalities involved and organisational influence as discussed in later book chapters.

Figure 3.1 illustrates our estimated integration and relationship intensity ratings as a guide only.

Table 3.1 Summary of project delivery forms in terms of integration and relationships.

<i>General form</i>	<i>Example</i>	<i>Integration intensity</i>	<i>Relationship intensity</i>
Separated	<p>Facilities/assets are procured through a design-bid-build (DBB) basis, either through fixed (or variable with inflation adjustment) price/time contracts or variants of cost plus work where the contractor does as instructed with an agreed profit and overhead mark-up.</p> <p>The main rationale and focus is risk acceptance, DBB = contractor acceptance and cost plus = PO acceptance.</p>	<p>Low, the client is often reliant on the architect (or engineer for infrastructure). The contractor performs a passive role.</p>	<p>Low, the power, information and influences and asymmetries between the OP, design leader and contractor is stark. Teams are wary of opportunistic behaviour.</p>
Integrated	<p>Masterman treats this category from a design and construction perspective. Examples are cited as various forms of design-build, often referred to as design and construct (D&C), but he also includes Turnkey and other forms of package deals. These are variously known as within three broad categories. Turnkey moved from design, finance and transfer ownership (the key) to forms of Build Own, Operate, Transfer (BOOT). During the 1980s a Private Finance Initiative (PFI) form emerged in the United Kingdom (UK) that ranged from BOOT to Build Own Operate (BOT). From the 1990s the PFIs transformed into PPP which resembled BOOT.</p>	<p>The common feature of these delivery forms is integration of financing, design and delivery, either upon completion of the project or at an agreed concessionary period. For BOOT and PPP in particular the PO procured a service not a product.</p>	<p>The relationship intensity in these forms is highly transactional between participants. Parties such as financiers are involved at project initiation to take a fee or to later sell their stake and then depart the consortium. The asset is usually delivered on a form of D&C. A special-purpose vehicle as the owner operates the facility for the government agency on a service fee basis.</p>
Management-oriented	<p>These projects are generally delivered on a fee-for-service basis with either a design-led consortium providing the management of the design and delivery process or the contractor doing so. The client engages the management contractor as an agent and pays direct costs and a fee for service. This form may be termed engineering procurement contracting (EPC), construction management or Management Contracting.</p>	<p>Integration is limited to the design and delivery business units within the EPC apart from limited PO involvement at the briefing stage. The PO and EPC entity are largely physically separated.</p>	<p>The client is highly engaged at the briefing stage. After that stage, the main engagement is between the design and contracting business units under the EPC entity.</p>

Discretionary	<p>According to Masterman (2002, p131) 'a discretionary procurement system is an administrative and cultural framework into which any procurement system(s) can be incorporated, thus allowing the client to carry out the project by imposing a very specific management style, or company culture, while at the same time enabling him/her to use the most suitable of all of the available procurement methods.'</p> <p>This form could also include framework agreements (FA) where an agreed fee structure is tendered and accepted for pre-specified types of work to be done. Joint ventures (JVs) also fit this category.</p>	<p>This form relies on a partnering agreement and so the integration intensity varies. FAs vary in terms of integration intensity. Likewise for JVs.</p>	<p>Partnering is a voluntary arrangement even a contract that embeds partnering is used. Therefore, the quality of engagement and relationship intensity is not guaranteed. While there is a relationship bond forged through the FA selection process it also varies in intensity. Likewise for JVs.</p>
Integrated supply chain	<p>This delivery form follows the model adopted first by the British Airports Authority for the Heathrow Terminal 5 building and then adapted for the London Crossrail programme and recently for the Thames Tideway Tunnel.</p>	<p>The integration of the sophisticated OP, the design teams, main contractors and the sub-contracted work package contractors is intense.</p>	<p>The relationship intensity between the OP, the design teams, main contractors and the sub-contracted work package contractors is intense.</p>
Alliancing	<p>There may be design alliances, project alliances or programme alliances but they all follow shared values and characteristics.</p>	<p>The OP, design teams and delivery contractors are highly integrated.</p>	<p>The engagement and relationship intensity between these participants is intense.</p>
IPD – Multi-party contract (NASE, COAA, APPA, AGC and AIA, 2010)	<p>IPD is contracted at three levels. We focus here on its most intense form where a multi-party contract binds the OP, design and contractor participants to deliver the project.</p>	<p>Integration is often very intense between the OP, designer and contractor, extending to major sub-contractors.</p>	<p>The relationship between the OP, designer and contractor, extending to major sub-contractors, is also intense.</p>

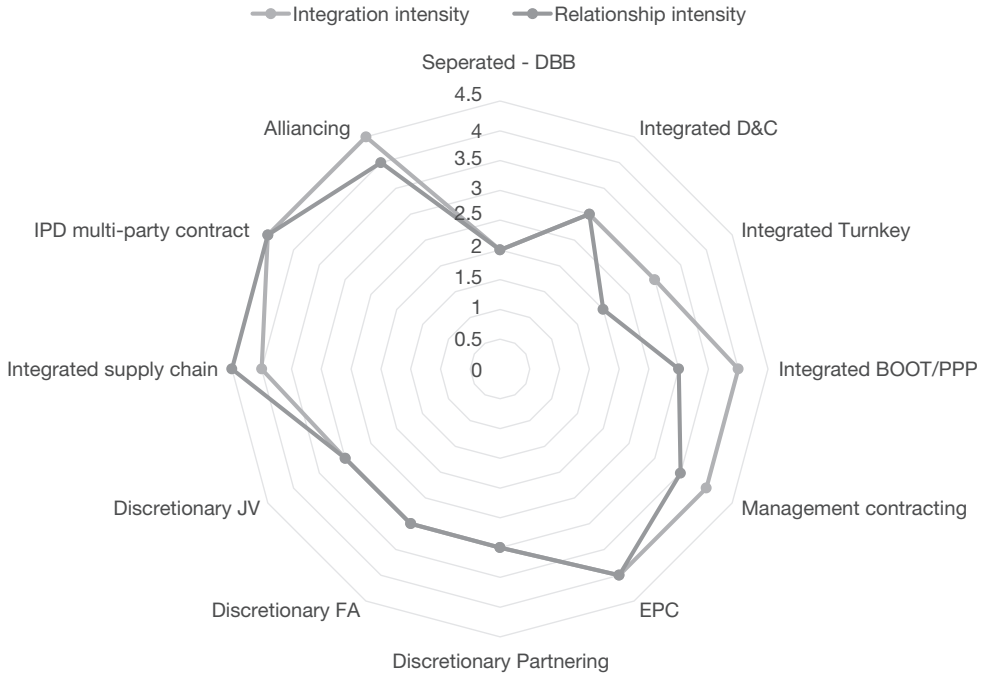


Figure 3.1 Procurement form integration and relationship intensity

Separated procurement systems comprise the traditional design-bid-build (DBB) approaches. Delivery forms such as DBB obviously involve some integration of the OP, design and contractor entities but it does so only in a highly fragmented and disjointed manner. This is due to the design team being at the centre of the triad but keeping a distance between the OP and contractor. The designer interacts with the OP at the early stage to develop the brief. After tendering the project to a group of competing contractor bidders, the design leader often takes on the role of supervising agent on behalf of the PO, in effect assuming the role of the OP. The integration between OP, designer and contractor is fragmented and loosely integrated (likewise between the contractor and supporting sub-contractors and suppliers) and the relationship chain is similarly loose and weak. These days there may well be closer integration through the use of building-information modelling (BIM) to maintain a central design database that provides design, construction and facility management information and other linked documents (Aranda-Mena, Crawford, Chevez and Froese, 2009; Arayici, Coates, Koskela, Kagioglou, Usher and O'Reilly, 2011; Khosrowshahi and Arayici, 2012). However, DBB does not automatically develop greater intensity of integration and relationship engagement. It is for this reason that we rate a low for both scales illustrated in Figure 3.1.

Integrated forms include various D&C and Turnkey as well as the BOOT/PPP variant forms. D&C may use either a straightforward design-build approach or use a novated D&C approach. Novated D&C has a PO-appointed design team work with the OP to develop a brief translated into a concept design that a successful D&C consortium bidder will develop further (Chan and Tam, 1994). The design and delivery part of the OP, designer and delivery entity triad may be closely integrated but not all three triad entities will co-locate or intensely collaborate as an integrated team. Similarly, the relationship intensities between parties may be

loose and weak and it is for that reason we rated them as being at the midpoint of a five point low to high intensity scale.

Turnkey offers a 'black box' integrated delivery form where deals are made between the designer teams, contractors, financiers and other groups that are needed to stitch together a 'one-shop' deal so that the PO specifies the need in terms of a brief then seeks responses from several Turnkey operators (Ahola, Laitinen, Kujala and Wikström, 2008). Often the client is somewhat locked into the specified brief and any changes of mind or design details can become a costly negotiation exercise (Masterman, 2002).

Other integrated forms include the evolutionary progression from Turnkey to the nest of systems within the BOOT group. This procurement form is service-oriented. The key issue is that a product (the facility) is not the deliverable but the outcome service. Instead of delivering a road or a train line this procurement form delivers a service to provide transportation for a set concession time, often around 20 or more years, that allows cost retrieval based upon revenues from 'the service' by the facility's end users. The BOOT family of systems include a build own operate (BOO) approach in which there is no set end point for a road project. This may mean that a road is built and tolls are paid either to the government transport authority or some other entity authorised under a concession to harvest tolls. The BOOT form adds a condition to transfer the asset at some specified time and in a specified condition at transfer. This is very similar to public-private partnerships (PPPs) where the PPP 'owner-instigator' is usually a government agency. PPPs evolved from the Private Finance Initiative (PFI) system that emerged from the 1980s in the UK (Grimsey and Graham, 1997). All these integrated forms are only integrated to a limited point. Often the integration, and relationship intensity, is limited to two parties within the OP design team and contractor triad. This locks out valuable context and operational knowledge, to inform design and delivery project decision-making. A hands-off PO or OP approach to project delivery starves the outcome of knowledge about what the values of the project outcome should be. This is a point that is stressed by Fischer, Khanzode, Reed, and Ashcraft (2017) who stress the need for an intelligent and sophisticated client to be part of the project delivery triad. PPPs and BOOT projects have a danger that the PO/OP will assume that rigid specification of the brief without a strong and knowledgeable engagement, resulting in inadequate engagement to ensure that the level of clarification of the brief is meaningful (Walker, 2016).

Management-oriented forms deliver early contractor involvement in order to provide valuable front-end and buildability advice (Mosey, 2009; Scheepbouwer and Adam, 2011). The construction management (for a fee) form of delivery provides a pragmatic results-oriented outcome deliverable (McGeorge and Palmer, 2002). However, this may result in overlooking the aesthetic and operational performance perspective if ease of construction and cost of delivery decision-making criteria dominate. The EPC form may be perhaps more integrated than the contractor-driven 'construction management' approach, especially for engineering projects, but there still may be dislocations and integration misfits as well as relationship challenges due to the tendency for EPC to be delivered through outsourcing based on cost rather than gathering together the best team to deliver the project (Walker and Lloyd-Walker, 2015; Rahmani, Khalfan and Maqsood, 2016).

Masterman (1992; 2002) devotes the category 'discretionary' to project and strategic partnering and argues that it can be added as a behavioural framework to any procurement approach. Partnering at the project level requires parties to engage in a workshop or series of workshops to develop a partnering charter and to make every effort to adhere to its aims and objectives. Protocols are also developed to guide participants and there has been much literature published on the concept (for example see CII, 1996; Construction Industry Institute Australia, 1996; Anvuur

and Kumaraswamy, 2007; Arup, 2008; Eriksson, 2010). It does have a fundamental drawback in that it is aspirational and mainly voluntary, so the agreement lacks teeth if any participant engages in backsliding or opportunistic behaviours (Green, 1999; Bresnen and Marshall, 2000; Ng, Rose, Mak and Chen, 2002; Bresnen, 2003). Strategic partnering attempts to provide longer-term incentives for collaboration and a joint vision of project success being a win-win prospect because the strategic partnering agreement binds the PO and other participants (usually on a D&C or management contracting arrangement) to longer-term commitments (Lendrum, 2003). Thus, if one project provides disappointing outcomes then others are likely to be more favourable, partially due to opportunities for organisational learning (Lendrum, 2003; Gibbs and Humphries, 2009). Strategic partnering sometimes takes the form of framework agreements (FAs) where a PO may invite organisations to participate in projects on an agreed schedule of engagement rates. This enables a programme of work to be delivered through several FAs that allow speed and simplification of tendering for many small projects or for larger projects that can be shared among the FA entities to optimise outcomes for both the PO and FA entity over the long term (Office of Government Commerce, 2008; Constructing Excellence, 2012; Department of Health, 2012).

A JV is a consortium of firms that collaborate and is usually formalised by a specific JV contract agreement that specifies limits and scope of collaboration. JVs may operate within any procurement form. JVs may undertake traditional delivery forms where each JV participant has a niche set of capabilities or shares the risk on large or complex projects. Similarly, JVs may undertake activities within a BOOT/PPP-type project form. They also vary significantly in their level of collaboration and relationship intensity (Kogut, 1988; Swierczek, 1994; Bing, Tiong, Fan and Chew, 1999; Johannes, 2004). The integration intensity level of JVs and the relationship intensity between JV participants vary but are generally high. However, integration and relationship intensity with the design team and OP participants in a project varies with the project delivery form.

Integrated supply chain approaches require a highly sophisticated OP. Often these may be seen as instigated by special-purpose government agencies. One clear early example of this approach is derived from the British Airport Authority Heathrow Terminal Five project (T5) which was a multi-billion pound mega-project (Doherty, 2008). It is clear from numerous research papers on that project that the T5 agreement involved very high levels of collaborative integration of the OP, design and delivery team (contractor and first-tier sub-contractors) and that the relationship intensity through the contract form and informal interactions was very high (Brady, Davies, Gann and Rush, 2007; Gil, Pinto and Smyth, 2011). T5 led to the application of lessons learned about integration and relationship development throughout the supply chain on the London Olympic Games megaproject (Brady and Davies, 2014) and then later on the London Crossrail programme and Thames Tideway Tunnel project (Davies et al., 2014).

Several authoritative works have emerged that explain IPD. A recent book provides, though almost exclusively from the USA perspective, a detailed and current state-of-the-art, very readable description of IPD theories, practice and insights into the USA experience of IPD (Fischer et al., 2017). The authors are reflective practitioners who understand the value of explaining context to readers who may be partially familiar, or completely unfamiliar, with the IPD concept. It is a book that is worth reading and in its preface, on page xxiv, it provides a quote from one of the authors, Professor Martin Fischer, succinctly expressing implications for a relational approach to project delivery, IPD:

A high-performing building can only be achieved through a building with integrated building systems, which can only be produced through an integrated process, which depends on an integrated team with the right people, which needs

integrated information, i.e., BIM+ to function effectively and efficiently. Simulation and visualization are the primary ways in which BIM+ informs the integrated team. Collaboration and co-location are the primary ways that allow the integrated team to integrate processes. Production management methods enable the productive design, fabrication, and construction of the integrated building system. Outcome metrics define the performance of the building and validate the integrated building system. All of this is supported by the appropriate agreement or framework.

IPD emerged from innovations to the lean-construction management concept that has had its primary focus on delivery efficiency and effectiveness (Ballard and Howell, 2002; Koskela and Ballard, 2006; Ballard, 2008). The notion of waste was extended from material waste to management effort, rework and design information integration waste (NASF et al., 2010). A number of studies on IPD, including individual and comparative case studies (American Institute of Architects – AIA California Council, 2007; American Institute of Architects, AIA Minnesota and School of Architecture University of Minnesota, 2010; Cohen, 2010; Pishdad-Bozorgi, 2016) clearly demonstrate that at the highest level of IPD that integration of teams and information that they use is very high and that the required relational engagement is also very high. IPD involves the OP, the design team and contractor together with their first-tier sub-contractors, although the sub-contractors often do not share in any pain/gain-share arrangements (Walker and Lloyd-Walker, 2015; Fischer et al., 2017). Another strong influence in shaping IPD has been the way in which BIM has been a catalyst in changing project processes and attitudes. BIM is not a 3D model but is in fact a process for storing and distributing information about the facility that is to be constructed and used. Thus, BIM has acted as a change agent that allowed IPD to develop by stimulating the development of a common data environment (CDE) that not only stores information from all participants but updates that information constantly and notifies participants of changes and so alerts them to the implications for their own information contributions. Hence, the process of IPD has been enabled through the CDE and a range of other digital tools and resources that take us beyond the concept of alliancing and into the most intense levels, thus far, of integration and collaboration. Additional facilitators of this include visualisation of construction projects, cross-discipline and cross-firm working from the same data set in developing design and the integration of design documents for planning building operations (Aranda-Mena et al., 2009; Fischer and Drogemuller, 2009). Co-location of the OP, design team and contractor delivering the project in a ‘big room’ also aids intense levels of integration and assists in coordination (Cohen, 2010; Ballard and Tommelein, 2012; Fischer et al., 2017).

Lahdenperä (2012) provides one of the most comprehensive and readable accounts of the evolution of alliancing. He traces its origins from Japan’s ‘gentlemanly principles (tradition)’ as part of the lean manufacturing and *kaizen* (continuous improvement) concepts to partnering in the USA and UK, then to alliancing via oil and gas industry projects in the 1980s. Extensive use of alliancing has been made in Australia and New Zealand from the 1990s to the present time and more recently it has been used in several European countries (Lahdenperä, 2012, p62). An extensive body of literature is emerging from Australia on alliancing (Rowlinson and Walker, 2008; Davis and Love, 2011; Walker and Lloyd-Walker, 2015; Walker, Mills and Harley, 2015) and New Zealand (Vilasini, Neitzert, Rotimi and Windapo, 2012; Ibrahim, 2014). All the literature demonstrates that alliancing generally delivers very high levels of project-team integration between the OP, design and construction delivery participants and that the level of relationship building intensity and collaboration is very high.

Having broadly illustrated the evolution of IPD in its many guises and intensities we will look at how the IPD variants are applied in a sample of countries in North America, Europe, Australasia and Asia.

Global state-of-the-art perspective on IPD-like forms of project delivery

In this section we have investigated the researcher literature into the application of project delivery systems throughout the world to gain additional insights to that presented in the previous section. Our aim is to present a more global view of how relationship-based project delivery is currently evolving.

We start our global journey at the UK, and head westward.

The United Kingdom (UK)

The UK has adopted and adapted various forms of partnering for many decades. One early example is the strategic partnering arrangements that governed the construction procurement of Marks & Spencer (M&S) stores and also their fit-outs by the construction group Bovis from the 1920s onwards (Cooper, 2000) using their management contracting model in which a prime cost sum plus a management fee was negotiated and savings on that estimated prime cost sum went to the project owner and not the contractor. Winch notes that during the 1980s when M&S began to develop a significant number of new builds and expansion on the European continent, it moved towards a more traditional, though still with a design-build basis, approach that involved deeper integration of the PO with consultants and Bovis (2004, pp118–120).

Another move towards integration and greater collaboration was demonstrated with the New Engineering Contract (NEC) although the 2005 and 2013 updated version NEC3 is more akin to an umbrella system of contracts. NEC4 was released in 2017 as a draft or preliminary form of contract for forming alliances. It is interesting to note from the NEC3/4 Guidance Notes (URL <https://gmhplanning.co.uk/nec-guidance-notes>) that many of the comments about clauses, particularly to do with trust accountability and responsibility, etc. are moving closer to the project alliance agreements used in Australia and New Zealand. This website states it is a trusted source for a number of major players in this area that have been involved in projects, i.e. T5 and Crossrail. The video www.youtube.com/watch?v=vrcQtNi2Soc briefly explains NEC4 over a four-minute video clip. The NEC contract forms have been developed over some 25 years or so according to the NEC official website www.neccontract.com/About-NEC/History-Of-NEC.

FAs have also been used in the UK for several decades (Khalfan and McDermot, 2006). FAs, according to the Manchester Business School:

... are similar to strategic partnering in that a client selects certain suppliers to supply services for a defined period, and there is a mutual intention to improve the quality of relationships and of performance over that time. The actual works will not be defined at the start of the period but once a project is defined there is a secondary selection process to determine which firm(s) will carry it out. Framework arrangements should be distinguished from framework contracts; in the latter, the relationship is purely contractual with no commitment to mutual improvement. The UK, particularly, has used this form of collaboration.

(2009, p9)

FAs have been used by local councils as reported in several case studies by Khalfan and McDermot (2006). The advantage is that for smaller-scale project work it is possible to have negotiated with several organisations so that, in maintenance and emergency situations, such as a burst water or sewer pipe, they can be rapidly repaired without a lengthy tendering and negotiation process being faced at times of crisis.

The NEC4 contract form evolved from experience gained by UK contractors, POs and design consultants on several landmark projects that could be described as vanguard projects: the Heathrow Terminal 5 project, Crossrail, The London 2012 Olympics and more recently High Speed Rail 2 (HS2). Vanguard projects are ones in which innovation becomes a stated project objective and it is clear that a significant expectation is that participants intend to learn and improve through undertaking those projects either by reacting to situations to learn (Brady and Davies, 2004) or by purposefully creating new products through experimental projects (Frederiksen and Davies, 2008). T5 demonstrated many advanced aspects of the purposeful establishment of a contract to fully engage the PO and other non-owner alliance participants (NOPs) such as the design teams, contractors and supply chain suppliers and sub-contractors as well as the facility operators (Doherty, 2008). Crossrail extended this concept, partially under the influence of Andrew Wolstenholme, the former T5 construction programme director and members of his T5 team that moved from T5 to Crossrail and onto other mega-projects in the UK (Caldwell, Roehrich and Davies, 2009; Davies, Gann and Douglas, 2009; Davies and Mackenzie, 2014; Davies, Dodgson and Gann, 2016). These mega-projects should perhaps be termed programs rather than projects as they involve a series of interlinked and interlocked projects within an overarching program of works. They also tightly link the supply chain through formal strategic arrangements to work together to improve performance through innovation and closer integration and knowledge sharing (MacAulay, Davies and Dodgson, 2018).

North America – The United States of America (USA) and Canada

The USA has been seen to be an early initiator of relationship-based project delivery with its early uptake of the quality management and collaboration systems introduced to Japan, referred to as ‘gentlemanly principles’ of tradition and later re-introduced to the USA in the 1980s as partnering (Lahdenperä, 2012). Lahdenperä’s paper provides a map of the world in which the various influences of project integration and collaborative work evolved. This reveals an interesting story of knowledge gained and lost and re-formulated again. His paper shows the project-partnering influence from 1988 that is also supported by the CII study on partnering (CII, 1996), and that the evolution of project alliancing in Australia and New Zealand subsequently influenced the USA when it adopted its direct adaptation of that concept for its IPD in its Integrated Form of Agreement (IFOA) (Lahdenperä, 2012). This development is also documented and acknowledged by those that adapted alliancing to meld with aspects of lean construction (Ashcraft, 2010; 2011). IPD has been reported as occurring at three levels of intensity, with the highest level closest in nature to project alliancing as practised in Australia (NASF et al., 2010). Readers who are interested in this link between lean construction, supply chain management and alliancing may refer to Chapter 17 of this book. Another good source for understanding how IPD is undertaken in the USA, which, while highly USA-centric, does explain IPD in the USA context extremely well is the book by Fischer et al. (2017). Case study accounts of IPD on the Cathedral Hill Hospital (CHH) in San Francisco is provided by Heidemann and Gehbauer (2011) and several other case studies of IPD (Lichtig, 2005) in papers and others are published in reports (Cohen, 2010) in the USA but also in both the USA and in Canada (American Institute of Architects et al., 2010; Cheng, Allison, Dossick and Monson, 2015). Lean methods are also used with increasing frequency in Canada, including versions of the IFOA.

Australia and New Zealand

There are ample sources of literature about studies of alliancing as an IPD form in both Australia and New Zealand. Early alliance projects such as the National Museum of Australia have been published in journal papers (Walker, Hampson and Peters, 2002; Hauck, Walker, Hampson and Peters, 2004) and extensive discussion in a book (Walker and Hampson, 2003). Other literature from this region highlights case studies (Young, Hosseini and Lædre, 2016) as well as theoretical concept papers (Cheng, Li, Love and Irani, 2004; Love, Mistry and Davis, 2010; Davis and Love, 2011), reports of studies (Walker and Harley, 2014; Walker, 2016) and results from surveys (Wood and Duffield, 2009; Walker and Lloyd-Walker, 2015; Walker et al., 2015; Walker and Rahmani, 2016; Manley and Chen, 2017). These provide insights into how alliances operate and perform from both a narrow time/cost perspective but also from a learning and innovation-diffusion perspective and from an ethics perspective (Lloyd-Walker and Walker, 2017). Additionally, there is a case study of an alliance that was formed within a PPP project (Jacobsson and Walker, 2013; Walker and Jacobsson, 2014).

There is also a growing body of literature about alliances in New Zealand taking a lean-construction perspective (Vilasini et al., 2012; Vilasini, 2014) as well as from an alliancing-team integration perspective (Ibrahim, Costello and Wilkinson, 2013; Ibrahim, 2014; Ibrahim, Costello, Wilkinson and Walker, 2017).

Much of this book draws upon insights of alliancing in Australia; readers may find much rich data including quotes from alliance experts and case study contextual information in many of the chapters in this book.

Southeast Asia and China

A number of countries, such as Singapore, Malaysia and the autonomous region of Hong Kong, have been steeped in the colonial system promulgated by the UK and which has changed a little over the past five decades. Hence, many of these Commonwealth countries have followed the traditional procurement route that was separated and driven by the professional silos of the colonial professions. Other countries were influenced in different ways by different systems such as those in the US and Japan. Currently, Hong Kong and Singapore are moving in the direction of IPD but with varying levels of achievement. In contrast, China is still, in the main, a demand economy that is under central government control and the construction industry abounds with state-owned enterprises (SOEs) that do not operate on a wholly commercial basis. These entities include design institutes, contractors, materials and other service suppliers. The nature of the system within which these entities operate is structured and is focused on meeting national demand, particularly focused around the National Five Year Plan promulgated by the State Council. For instance, in the current plan the government has indicated that 140 million social-housing units will be produced within that timescale. It has also indicated that up to 60% of this output must be accomplished by using volumetric and Design for Manufacture and Assembly (DfMA) approaches to prefabrication. This is a policy designed to meet both social-housing and ageing-workforce issues that are key problem areas at the present time. However, this policy is driving major changes in the industry and semi-automated factories of 200,000 m² and more are being constructed in many provinces to meet this demand. As such, one might say that this policy has driven a move towards both IPD and more effective and widespread use of BIM in order to make the design and construction and use of buildings more efficient and effective. Great emphasis is being placed on energy efficiency as part of this process.

As far as Hong Kong is concerned, the construction industry could be described as very traditional. It has relied for many years on procedures and processes laid down by government bodies such as the Development Bureau (DB, the strategy formulating body) and the Buildings Department (BD, a functional, approval body). These institutions have, in different ways, both driven and inhibited innovation and it is only recently that moves have been made to dramatically change the nature and focus of the industry.

These changes were perhaps initially driven by the need to construct the new airport at Chek Lap Kok before the handover to China in 1997. This required 14 major infrastructure projects to be completed within a very tight program. This led to the formation of the new airport project coordination office (NAPCO) that took over the programme management of these projects. This was a first for Hong Kong in terms of managing a programme of projects. This also led to the development of a project managing and monitoring system that was digitally based, and also a move towards more novel payment methods, such as milestone payments. Also, the use of more PPP approaches in order to lessen the management and financial burdens on the government itself were implemented. Beyond the handover, Highways and other government departments looked to move towards a partnering approach in order to facilitate the design and construction of major projects. This partnering approach was tried on a voluntary basis initially and then on a contractual basis and it is fair to say that it met with mixed results. The partnering process not only demands that individuals and teams come together to form and agree common goals and objectives but it also requires a much greater degree of trust and collaboration than the traditional contracts that had been used in Hong Kong in the past. Unfortunately, the conditions of contract under which the partnering projects were run were still very much of the hard dollar, adversarial type and no matter how much facilitation took place there was still a copy of the contract kept in the drawer ready to be taken out and clauses cited.

However, DB persisted with process innovations and moved on, eventually, to a trial programme using the NEC3 contract. This provided a better background and atmosphere for collaboration and for partnering to take place. Experimentation with cost plus and pain-share/gain-share contracts helped this process along. However, many of the projects undertaken initially were of relatively small value, HK\$ 200M or so. This made it rather difficult for the larger contractors to be able to participate wholeheartedly in the process given the nature of the overheads associated with such smaller contracts for large companies. Another impediment was the overly excessive use of 'Z clauses' that recited a number of the old Government Conditions in the contracts. Thus, the experiment with relational approaches to contracting could be said to have foundered on the twin issues of traditional reliance on the conditions of contract and a lack of change in terms of attitude and trusting behaviours by the participants. Additionally, despite DB's best efforts to ensure that a flow of projects of relatively high value was maintained, opposition to some of the developments in the Legislative Council and from environmental groups meant that the demand in the market still fluctuated wildly. Hence there was little incentive for contractors to adapt and change their methods of contracting when the guarantee of continuing workload was not there.

Currently, the Hong Kong government has issued the document Construction 2.0 (Hong Kong Government, 2018) that emphasises a move towards collaborative contracting, mandated use of BIM, more extensive use of the NEC contract and an emphasis on design for volumetric DfMA in housing production. Quite frankly, this is a big ask for an industry that has an ageing workforce, has been characterised in the McKinsey report (2015) as adversarial and of low productivity and has witnessed a continuously fluctuating workload – feast and famine – over the past 20 years.

For Singapore, there is a different story. The government and the government bureaus have a well-defined process in place for putting forward and approving projects. The government has a

continuous program of public housing provision and reclamation to allow for more construction. The Building Construction Authority (BCA) has mandated the use of BIM for all building approvals and for all government projects to be BIM-enabled. However, the industry has a mix of local and international contractors, particularly for civil engineering works, and the labour force is comprised mostly of imported labour from around the region. Thus, although there is a well-defined and reliable workload, the system for delivering projects is not necessarily suited to delivery in an IPD process. Suffice to say that the approach adopted by Singapore is some way ahead of Hong Kong at this present time. With its proximity to neighbouring Malaysia, Singapore has access to factories that can produce large-volume precast units. The move towards industrialised construction using BIM as a process is driving the industry in a direction where the process is integrated through to the supply chain. The emphasis on energy efficiency in the production of buildings as a goal of IPD is certainly within reach.

It would be fair to say that Malaysia and a number of other countries in Southeast Asia are not as advanced as Hong Kong and Singapore in the move towards IPD. However, there are a number of major contractors, consultants and clients that have started driving the move towards more integration through the process of enabling BIM in their projects. However, it has to be borne in mind that this move to an IPD process requires a well-thought-out and accessible and stable data environment as well as an attitude change, moving away from professional silos and adversarial attitudes to a collaborative and inclusive approach to the whole lifecycle of the building or facility. This is not easy to achieve in one generation, yet a change in the delivery process is essential for newly developing digital processes and technologies to work effectively.

Given the foregoing, it is worth noting that many property developers, particularly in Hong Kong, are very highly integrated and come close to performing in an IPD fashion. These organisations have an interest in the whole lifecycle of the building and will ensure that their facilities managers are part of the team that initially assesses each project. Thus, with this vertical integration of both the in-house team and the supply chain, such as curtain wall manufacturing facilities, concrete supply facilities, utility suppliers and many other aspects already in place, the developers have the best chance of achieving IPD rapidly.

The situation in China is somewhat different. With China being a massive country the demand economy still has great influence in terms of governance and distribution of resources. However, the government also has the power to mandate the use of processes such as BIM and volumetric/prefabricated construction. Thus, the change in China is being driven by policy from the top and innovation and technology utilisation at the work face. Chinese companies have embraced technologies such as drones, photogrammetry, big data analytics and energy-efficiency monitoring systems wholeheartedly. This is undoubtedly a prerequisite for the successful delivery of IPD. The emphasis on more offsite production and the logistics of dropping components in is also a very helpful driver of this change. The young engineers coming into the industry come with a can-do attitude and a view that technology as developed in China is there to be used innovatively and to improve the lives of the people.

Given the huge demand in China there is plenty of scope for innovation and novel approaches to both provision of facilities and business models. The large communications companies such as Ali Baba and Ten Cent have a need for large areas of storage for both goods and, in data centres, services. Hence, they are moving into the role not only of communications providers but logistics. As such, they are capable of actually driving the design, construction and production within the buildings that they need to have delivered. Yes, they are breaking down the traditional silos that existed in the Commonwealth countries' procurement systems by changing the nature of the process by which the facilities are delivered. This can only be a good thing.

Europe

While much of the Europe Union (EU) countries felt constrained by EU rules on competition and collusion that restrained EU countries from adopting alliancing similar forms emerged and after some time an EU ruling clarified the meaning of competition to allow alliancing to occur. This triggered a surge of alliancing projects in Finland with recent literature emerging that reports on alliancing concepts from the Finnish perspective (Lahdenperä, 2009;2014;2015) with case studies being reported on from stakeholder engagement and project learning perspectives (Aapaoja, Herrala, Pekuri and Haapasalo, 2013; Aaltonen and Turkulainen, 2018) as well as recent work that investigates how the OP and NOPS align their professional and organisational cultures to work as an integrated and collaborative team (Matinheikki, Arto, Peltokorpi and Rajala, 2016; Matinheikki, Aaltonen and Walker, 2018).

There has also been an interest in Norway with evaluation of forms of partnering and collaboration that under the Norwegian system gets close to the alliancing concept. There have been case studies from the hydrocarbon sector (Børve, Ahola, Andersen and Aarseth, 2017; Børve, Rolstadås, Andersen and Aarseth, 2017) as well as case studies including one of the major hospital construction projects in Norway (Bygballe, Dewulf and Levitt, 2015; Bygballe, Swärd and Vaagaasar, 2016).

In Sweden, one PhD thesis was written on a case study from the energy distribution system industry sector in which a form of partnership was developed between the PO and NOPS. On further examination of how the procurement system actually worked in light of alliancing literature, it becomes clear that it was a form of IPD closer to an alliance than other IPD forms (Jacobsson, 2011a; 2011b). Key aspects of the relationship was the solid integration of the OP design and contractor NOPS, the quality of their integration and collaboration and the flexibility and versatility of the three parties in working together to solve various technical and other problems that cropped up and were successfully solved.

The Netherlands is another country in which alliancing has been reported as being delivered for infrastructure projects (Laan, Voordijk and Dewulf, 2011; Hartmann and Dorée, 2015). The Dutch have also extensively used the competitive dialogue (CD) approach for procurement of integrated teams that collaborate with the PO (Hoezen, 2012; Hoezen, Voordijk and Dewulf, 2012a; 2012b; Hoezen, Voordijk and Dewulf, 2013; Haugbølle, Pihl and Gottlieb, 2015).

The CD is similar in many respects to the development of the target outturn cost (TOC) time and scope process in alliancing. TOC development is explained in this book in Chapter 27 in detail. The CD, however, is very much a front-end activity in which several IPD syndicates work with the PO to explore ideas and further value-adding options to the initial brief scoping information. Hoezen et al. (2012a, p6) state that:

The CD procedure is meant for the procurement of complex projects, of which technical, legal and/or financial solutions are not objectively specifiable by the contracting authority. It is, however, unclear how interaction processes during the negotiations and commitments in terms of formal and informal contracts are interrelated in the CD.

They explain in detail how the CD process works in practice, using a case study example to reveal insights about the CD process from analysis of critical incidents and discussions with practitioners engaged on the case study project by accessing archival data and retrospective interviews. The project involved maintenance of an existing 40-year-old tunnel and the construction of a second tunnel alongside the current one. The original contract form was a Design-Build-Finance-Maintenance (DBFM) contract made by the Dutch Minister of Transport in March 2005 with the

CD process being used to negotiate a new contract for 30 years from 2008 to 2036 for maintenance and additional work. The project was both technically and financially complex. Two contractors formed separate CD syndicates to negotiate with the PO with one successful contractor outcome. The outcome from three critical events during the negotiations determined the successful contractor. One event related to specifications and risk allocation of damaging the existing tunnel, a second was the development of a monitoring system for the construction stage and the third was the actual state of existing tunnel and roads and the agency's specifications.

Key aspects of the CD process that resonate with the TOC development process for alliances detailed in Chapter 27 include the way that uncertainty and ambiguity was resolved through the CD process where the PO and contractor genuinely explored and challenged assumptions. This allowed the PO and contractor to arrive at novel solutions to challenges in a flexible way. This approach impacted upon the development of the scope of works, pricing and estimated time for various tasks in the new works and refurbishment parts of the program. It was clear that this process involved sense-making by both the PO and contractor by heightening their perspective, taking skills to rigorously work through issues so that all parties had a far clearer understanding of the nature of the works. Thus cost and other savings were not gained through cost-cutting scope changes or relying on optimistic assessment of risk and uncertainty, rather they were based on a deeper understanding of the project. In this respect it shared many similarities with alliancing at the TOC development phase. Thus in the Netherlands we see examples of alliancing similar to the Australian–New Zealand style along with examples of the CD process.

Germany has not embraced alliancing but we find examples of forms of partnering that move closer to an alliance or USA IPD-style project delivery form. Spang and Riemann (2014) undertook a survey of construction infrastructure project-management professionals and they discuss how partnering is perceived from a German context and they develop a partnering guideline of objectives that closely follows the aims and objectives for the CD process as well as for IPD and alliancing. It is interesting to note that their paper, published in 2014, was written around the time that the Finnish Transport Authority had sought, and eventually gained acceptance by the EU regulators, to permit alliancing in a finding that alliancing did not contravene EU competition regulations. Other examples of German collaborative IPD forms includes evidence from a North German syndicate of project owners, designers and contractors

A case study of a German organisation *Baufairbund* (BFB) (Lönngren, Rosenkranz and Kolbe, 2010) reveals some interesting insights. The case study authors described the partnership role as follows:

The close cooperation among the parties involved provides a comprehensive service for building and tenancy that is intended to offer the entire spectrum of life cycle and value creation in the construction industry, from the original consultation through to the planning and realisation of the building project up to and including subsequent services surrounding financing and facility management, e.g. maintenance and operation. The main difference between BFB and a general contractor is that the BFB is not limited to the building project, but is committed to long-term collaboration. In this way a learning process can take place during the cooperation of the various trades. . . .

During the actual construction phase, the main responsibility of the BFB is project management. This comprises the supervision of project progress in terms of deadlines, but also quality standards. At the same time, detailed planning and the exact coordination of the various trades is being elaborated, in order to guarantee the seamless flow of work at the construction site.

(Lönngren et al., 2010, p408)

This provides an interesting form of partnering moving towards alliancing. Key vital elements of shared similarity between BFB and alliancing are trust between partners and a common IT platform that helps to integrate and coordinate participants to focus them on projects.

Other countries/areas

This section has explored global IPD practice in a number of regions to cover a wide part of the world. We find little published evidence of IPD and alliancing being practised in Africa or South America, however, we know from participants in lean-construction conferences that it is possible that the IFOA may be considered or piloted but perhaps not yet documented. An interesting recent PhD thesis examines 16 case studies of Framework Agreement Contracts in depth and from that thesis (Ayegba, 2019) the form of agreement is highly consistent with Program Alliancing in Australia. In South America for example, members of the School of Engineering Pontificia Universidad Católica de Chile have been active members of the Lean Construction Institute (LCI) since the mid to late 1990s. The LCI supports the IFOA as one tool and approach to improve collaboration between the PO and other project delivery parties.

In the logistics integration PM sector, we know of a unique form of integrated collaboration being undertaken through a mechanism referred to as the Atlantic Corridor (Arroyo, 2009). This was described as a kind of community of practice or joint-venture syndicate. Arroyo (Arroyo and Walker, 2008, 2010; Arroyo, 2009) reports upon several case study examples where companies from various Latin American countries formed an integrated syndicate of participants, each with their own contribution to provide an end-to-end transport solution that involved shipping, docking and ship maintenance, insurers and customers such as large iron-ore miners to collaborate within what may be viewed as an alliance.

The rate of acceptance of the expected IPD and alliance behaviours and leadership traits may be explained in part by the norms held by organisations participating in projects.

Explaining the current IPD-alliancing global state of play

The impetus to engage in IPD and alliancing-type forms was discussed in detail in Chapter 1 with Table 1.1 identifying seven distinct motivations to collaborate. Features that triggered the adoption of IPD and alliancing in the countries and regions discussed above are shared globally. Challenges and complexity of projects in some regions may be due to isolation or poor supporting infrastructure in some of the remote regions where engineering infrastructure projects, logistics projects and other type projects where a ‘thing/product’ is delivered, such as a building, a dam, a mining product distribution system, etc. In other regions there may be other sources of complexity such as corrupt or antagonistic political systems that make navigating regulations, permits and approval systems very difficult. This may cause severe problems to begin to collaborate with them (see Chapter 14 on stakeholder engagement for discussion of co-generation of value with stakeholders). In other places, there are opportunistic or hostile stakeholder groups such as militant unions or an aggressive general public that is opposed to the project to be delivered. All these comprise forms of complexity. The *core* issue is overcoming complexity through collaboration and integration to enable a great breadth and depth of intellectual and other resources to be effectively applied. Table 1.1 in Chapter 1 details other reasons why an IPD form such as an alliance may be appropriate. All these motivations would be common globally to some extent or another. So why is this approach not adopted globally?

We see that alliancing has been entrenched in Australia and New Zealand for several decades. When we have interviewed highly experienced alliance managers and key team members, for

example in research undertaken in 1999 on the National Museum of Australia (NMA) project, we received interesting background history about the impact of aggressive industrial relations (IR) and union militancy on decisions to find ways of engaging with them (Walker, Peters, Hampson and Thompson, 2001). In that paper, one of the authors was an ex-union builders' labourer who had returned to study as a mature student to complete a law degree and practice in a high-profile law firm. His insights published and included in that paper as well as unpublished and shared with co-authors indicate that alliancing in Australia was significantly triggered by the motivation to get the PO to join the design and contractor NOPs to find ways in which potential IR problems could be obviated through changing the workplace culture. The NMA project was successfully delivered ahead of schedule as well as from a number of other key results area and associated key performance indicator (KPI) measures (Auditor-General of the Australian National Audit Office, 2000; Hauck et al., 2004). The workplace IR culture was also observed (by one of the authors of this chapter who made many research site visits during its construction) to be significantly more cooperative and collaborative than many other construction projects at that time. The approach to include the unions in a sub-alliance type agreement with agreed responsibilities and KPI performance measures in place appeared to have a significant impact on successful project delivery (Walker et al., 2001).

We see in Chapter 10, for example, on the cultural perspective of IPD, that some organisations may remain highly hierarchical and commercially predatory and opportunistic. Some participants in projects from a range of organisational backgrounds may also be limited by their national cultural heritage of high power-distance, high uncertainty-avoidance and non-inclusive values and norms. These do not fit the IPD and alliance model. This suggests that some national cultural traits such as high power-distance, low uncertainty-avoidance and high individualism dimensions may find it harder to adjust to the cultural norms required of IPD and in particular, alliance projects. These national traits may coincide with difficulties in changing an organisational culture in which 'management prerogative' is believed to be a right and non-negotiable. Similarly, cultural bias (national, organisational or professional) towards deference to power may inhibit the level of challenging assumptions and expert-power gaining traction. This may impact collaboration to stimulate innovation. However, most parts of the world have people from a multi-cultural background working in the teams delivering projects, therefore the influence of national culture (as explained in Chapter 10) must be able to be moderated. If this were not the case then IPD and alliancing would not have been so prominent in the range of countries outlined above.

Chapter 5 outlines aspects of client capabilities and this may help explain why some POs may find the concept of IPD-alliancing difficult to accept; and Chapter 11 discusses the knowledge, skills, attributes and experience (KSAEs) required of IPD teams, suggesting that in some countries or regions these KSAEs either are not sufficiently valued or else are poorly developed to sustain significant numbers of IPD-alliance projects being delivered.

To answer the research questions posed in this chapter's introduction, we suggest that the uptake of IPD-alliancing may be mainly explained from a cultural perspective—primarily how the organisational and workplace culture operates. Another major influence is history. Lahdenperä's map (2012, p62), illustrating how the concept of relationship-based forms of project delivery evolved and were diffused and transformed *en route*, provides a useful means to understand how IPD-alliancing has emerged and evolves. With the recent release of the NEC4 contract we may expect greater expansion of alliancing-like project delivery being undertaken

The challenge of clients gaining the necessary freedom to act as well as gaining the necessary knowledge, skills, attributes and experience (KSAEs) should not be underestimated. IPD emerged in the USA out of a crisis in 1994 when an earthquake in California significantly damaged

critical health facilities. Legislation was passed that required many institutional structures to be 'earthquake-proofed' with significant structural seismic work undertaken by January 1st, 2013. This required a great surge in building structural upgrades while others had to be demolished and replaced (Lichtig, 2005). In the USA case the legislation enabled a total rethink about how complex projects could be delivered and this allowed clients to make a quantum leap in the flexibility to act differently to their business-as-usual practice. In the UK, the enabling trigger to construct differently was triggered by two key reports (Latham, 1994; Egan, 1998) that highlighted a history of declining building productivity through a plethora of reports dating back to shortly after World War II (Murray and Langford, 2003). The successful construction of Heathrow's Terminal 5, based on a completely different project delivery approach, led the way to changes in the UK with further adaptations of what became to be known as the 'T5 agreement' (Doherty, 2008) and this helped to shape the way that large scale complex projects are being undertaken in the UK (Davies et al., 2014; Davies and Mackenzie, 2014) and we see NEC4 as the next chapter in the story of evolution and take-up of IPD forms in the UK.

We suggest that IPD and forms of alliancing will become far more widespread globally. Many recent foresight reports that attempt to make sense of workplace trends and conditions moving from 2030 beyond, all suggest that intense collaboration will be the norm in the management of future projects as widespread digital economy features such as robotics, artificial intelligence (AI) and augmented digital technologies all reduce the level of routine work being undertaken by humans and demand for work of specialised systems integration by humans increases (Committee for Economic Development Australia, 2015; World Economic Forum, 2016; Jacobs, Kagermann and Spath, 2017; PwC, 2017). This trend suggests that IPD and alliancing forms will increase over time and become more geographically dispersed over coming years.

Conclusions

This chapter discusses the current global state of play of IPD in general and alliancing in particular. It also explains general forms of IPD in Table 3.1 in terms of their level of integration and collaboration and maps these as illustrated in Figure 3.1. This provided a basis for underpinning what we mean when we refer to IPD-like forms and allows a fuller picture of the terrain under discussion in the chapter.

The discussion of the global adaptation of IPD forms followed and it is clear that in alliancing terms, Australia is a leading influencer in its adoption in Finland and the Netherlands in particular. The IFOA form of IPD is established and growing in the USA and North America and will continue to influence regions where lean-construction principles are accepted and adopted. The UK has a very strong pedigree in its IPD-form evolution from the T5 agreement onwards, with solid experience of FAs for smaller-scale projects and the NEC4 continuing to be a solid influence due to its historic credentials.

We suggest, based on industry and government foresight reports we cite, that the digital economy, and in particular the way that AI-augmentation technology is likely to evolve, that there will be significant increases in collaboration and IPD in future.

We conclude that one of the significant and pressing challenges that face project-management professionals in general, and in the engineering infrastructure and construction sector in particular, will that the PO will need to gain collaborative competencies and abilities to excel in collaborating with others in an integrated team to take advantage of innovation and improved project-external stakeholder engagement benefits that IPD offers for complex projects. We also conclude that for all IPD project members, that gaining and maintaining the requisite KSAEs will pose a challenge that they will have to cope with and overcome.

Note

1 www.cibworld.nl/site/home/index.html.

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