

Special Issue: Innovation in Infrastructure Delivery Models
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Delivery Model Innovation: Insights from Infrastructure Projects

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This special issue seeks to bring together contributions of a nascent community of scholars studying infrastructure delivery models; what they are, how they are created, and how they change over time and across institutional fields. This area of research is crucial to advancing the field of project management and, with its links to neighboring fields such as innovation, organizational theory, and strategic management, is a fertile ground for developing new insights and knowledge. Before we introduce the articles that make up the special issue, we describe the policy environment and drivers for innovation in infrastructure delivery models, situate infrastructure delivery models within project management scholarship, and provide some conceptual scaffolding for considering the nature of innovation in delivery models. We then turn to a discussion of how each article in the special issue advances our knowledge of delivery models and project management. Drawing inspiration from the articles, we conclude by sketching out the building blocks and core conceptual components of a delivery model, and laying the foundations for a more nuanced comparison of existing, emerging, and novel delivery models over time and across institutional fields.

What is Infrastructure and Why is it Important?

Infrastructure incorporates the systems, network utilities, constructs, and other physical assets that underpin and enable social and economic development (Bell, 1973; Chandler, 1977). It connects firms and markets and provides people, communities, and organizations with essential services. It delivers significant benefits, both directly through the services it delivers, and indirectly, through the impact of those services on the rest of the economy. Countries depend on infrastructure to move people, materials, goods, and information rapidly, efficiently, and reliably between geographical locations (e.g., road, rail, aviation, and telecommunications); to provide access to dependable and secure sources of water and energy (e.g., water, gas, electricity, nuclear, and renewables); to process and treat waste (e.g., sewer systems and incineration plants); to educate, support, and protect a literate, healthy, and law-abiding population (e.g., schools, public housing, prisons, and hospitals); and to

create a culturally diverse and advanced civil society (e.g., sport stadiums, opera houses, and other distinctive buildings).

Infrastructure is expensive to build, operate, and maintain, and often produces large negative externalities, such as CO₂ emissions, noise, and pollution. It is typically long-lived, so the costs of any poor choices, let alone mistakes, can be extremely high. And, as we will see, major infrastructure projects are often delivered late, over budget, and fail to achieve their expected benefits. Given its importance for the prosperity of societies in the 21st century, public and private actors are searching for new and improved ways of delivering infrastructure projects. In mature market economies, governments in the United States, United Kingdom, France, and others are experimenting with new ways of delivering infrastructure projects to repair, upgrade, and replace ageing and obsolete assets such as metro, rail, and road networks built many years ago. In emerging market economies, governments in India, Mexico, and many other countries face difficulties in attracting the funds and developing the capabilities needed to undertake huge investments in new infrastructure to meet the needs of their rapidly urbanizing and growing populations (e.g., Mahalingam, 2009). Confronting these challenges requires the development of radically new delivery models.

Delivering Infrastructure in a Changing Political Environment

Understanding the new project delivery arrangements requires an appreciation of how infrastructure was owned, organized, and managed in the past. In the United States and Europe, telegraph, telephone, railway, electricity, and many other infrastructure networks in the 19th century were initially financed and built by private firms in a competitive market (Levitt, Scott, & Garvin, 2019). These early forays were subject to market failure after some initial successes, and private firms could no longer attract investment or offer efficient alternatives to local, regional, or national monopolies. Most infrastructure networks eventually formed natural monopolies or contained monopoly elements. Thus, how they were financed and organized to provide essential services was a matter for governments to decide. As a result, during most of the 20th century, infrastructure was placed under monopolistic public ownership or regulated private provision. National, regional, and local governments played a major role in the funding, development, and operation of infrastructure.

During the 1980s and 1990s, however, when a liberal political agenda took hold in the United States, United Kingdom, and elsewhere, calls intensified for private sector involvement in the construction and operation of national infrastructure utilities, airports, ports, railways, and other networks. Facing increasing pressure to reduce public spending, governments around the world began to explore how the private sector could be used to finance and build infrastructure projects (Gil & Beckman, 2009; Levitt et al., 2019). There were two main arguments motivating this agenda. The first was that private finance would allow governments to attract the investment needed to launch much needed infrastructure projects without raising taxes, issuing bonds, or increasing government spending. The second was that private firms had organizational advantages that made them more efficient and customer-focused than government-owned monopolies. Efforts were then made to design new delivery models aligning public and private interests.

We refer to the United Kingdom, which has been a laboratory for experimentation in infrastructure project delivery, to illustrate how politics, policy, and project management intersect to shape innovation in delivery models. The Private Finance Initiative (PFI) was introduced in 1992 as the primary means of funding new public projects, such as schools, hospitals, prisons, railways, and highways. Under PFI, private sector firms are required to finance and design, build, and operate assets, such as the London Underground, often for many years. PFI was attractive during a time of fiscal austerity, because private investment in infrastructure did not count as part of government spending (the Public Sector Borrowing Requirement), but did commit the government to regular expenditures spread over the life cycle of the asset for decades ahead. PFI required private firms to develop entirely new delivery models. For example, under the £400 million PFI contract awarded in 1995 to modernize the Northern Line of the London Underground, Alstom was not required to build a specified number of trains, but to ensure that 96 trains were available for service every day during the life of the project (Wolmar, 2002). Provided the trains were available, Alstom was paid around £40 to £45 million a year plus a bonus, but had to pay a penalty every time the trains were cancelled because no train was available.

Whereas under PFI, the private sector finances projects and assumes the risk, under the new policy of Public-Private Partnerships (PPPs) introduced in 1997, the state assumes greater responsibility for project delivery. PPP infrastructure projects—such as High-Speed 1, the Channel Tunnel Rail Link project—are partly financed by the private sector, but the state

retains ownership of the assets and underwrites or shares some of the risk. The private sector firm or consortium is paid for investing in the assets through customer charges or government payments. PPPs were already used in Australia in the early 1990s to finance and build roads, hospitals, water and electric power; spreading during the mid-1990s to ports, prisons, and sport stadia; in the late 1990s to airports; and in the early 2000s to defense, schools, and courts. PPPs have been used in the United States since the 1990s to provide water supply and wastewater treatment, run prisons (Kwak, Chih, & Ibbs, 2009), and adopted by many European countries including Spain, the Netherlands, Denmark, Germany, Hungary, and Italy (Bult-Spiering & Dewulf, 2008).

While a growing number of countries are adopting PPPs, this model for delivering infrastructure projects has not only met with mixed success, but is increasingly viewed with skepticism in the United Kingdom. Reports by the UK National Audit Office (NAO, 2003, 2005) comparing the construction performance of PPP and traditional procurement found that only 30% of conventionally procured projects were delivered on time and 27% within budget compared to figures of 70% and 78% for PPPs, respectively. Despite this relative success, however, the high-profile failure of several early PFI and PPP projects and the collapse of major private entities (e.g., London Underground's Metronet and Tube Lines consortiums) illustrates the difficulties in writing equitable and efficient contracts for large, complex, and long-term infrastructure projects. Following a detailed review of the performance of PFI, the UK government published a report in 2012 outlining a new approach called *PF2* (HM Treasury, 2012). The report recognized that PFI works well when conditions are stable and predictable, but identified a number of problems associated with the original PFI delivery model, such as a slow and expensive procurement process, the inability to adapt PFI contracts to changes in requirements during the life cycle of an asset, and a failure to transfer risk to the private sector. However, *PF2* was used only sparingly and in November 2018 the UK government announced that it would no longer be used as the model to deliver government projects (HM Treasury, 2018).

Innovation in Infrastructure Project Delivery

Against the backdrop of these wider changes in the policy environment, clients and contractors also began to recognize that there was a need to improve performance by developing new models of project delivery. Under the traditional approach most commonly

used in the 1980s and 1990s, clients assumed that they could identify most of the eventualities that might impact a project, freeze the design at an early stage, select the lowest cost tender, and use fixed-price contracts that transfer risks to the contractor. This arrangement created adversarial relationships between parties when things went wrong or the project was delayed or over budget. Clients and contractors would often end up in court to resolve disputes over responsibility for scope changes or unforeseen problems leading to cost and time overruns (Egan, 1998).

In the United Kingdom, for example, the Jubilee Line Extension project of the London Underground was built to connect the West End with the Canary Wharf office complex and south and east parts of the city. It was a fixed-price contract scheduled for completion in March 1997 at a cost of £2.1 billion (Wolmar, 2002). Many contractors on the project had submitted low-cost tenders with the expectation that they could recoup their costs and earn additional profits by submitting £500 million for claims to changes in specifications and unexpected difficulties during construction. As a result of these disputes, the project was eventually £1.4 billion over budget and opened for service two years later than originally planned.

In different parts of the world, sponsors (owners and operators of the assets), clients, and their partners (consultants and contractors) began to search for more flexible and adaptive ways of delivering large infrastructure projects (Lahdenperä, 2012). They wanted to encourage collaboration, stimulate innovation, and create added value through the entire life cycle from design, construction, assembly, and integration to operations and maintenance.

In the United Kingdom, a new form of relational contract between client and contractors working together in integrated project teams was developed for the North Sea oil and gas exploration projects in the 1990s (Barlow, 2000). This collaborative approach was built on to deliver the £4.3 billion Heathrow Terminal 5 (T5) project between 2002 and 2008 (Gil, 2009; Gil & Tether, 2011; Davies, Dodgson, & Gann, 2016). Under the T5 Agreement, the client—BAA, the former state-owned British Airports Authority, now owned by Heathrow Airport Limited—entered into a novel risk-bearing contract and worked with contractors in integrated project teams (Gil, 2007, 2009; Davies, Gann, & Douglas, 2009). The project was pioneering in its use of offsite prefabrication, modular construction, and digital technology to model the design and construction of the T5 infrastructure (Tee, Davies, & Whyte, 2019). The T5

project radically transformed how subsequent infrastructure megaprojects—such as the London 2012 Olympics and Crossrail—are delivered in the United Kingdom and initiated a national and increasingly international narrative about the need for flexibility, collaboration, and innovation (Davies, 2017; Davies, Dodgson, Gann, & MacAulay, 2017). Inspired by T5, for example, Crossrail was an early UK adopter of digital technology called Building Information Modelling (BIM) and pioneered the development of an innovation program encouraging contractors, suppliers, and other stakeholders to develop, implement, and share new ideas, technologies, and practices (Davies, MacAulay, DeBarro, & Thurston, 2014; DeBarro, MacAulay, Davies, Wolstenholme, Gann, & Pelton, 2015; Dodgson, Gann, MacAulay, & Davies, 2016).

The North Sea experience influenced the development of project delivery models in Australia (Lahdenperä, 2012). The “alliancing approach” created by BP to build the Andrew offshore oil platform in the North Sea (Barlow, 2000) was adopted in 1994 to deliver the Wandoo offshore oil platform in Western Australia and, as a result of its success, spread to many other Australian infrastructure projects (Wood & Duffield, 2009). Collaborative relationships and risk-sharing contracts between project participants were a major feature of this approach (Love, Mistry, & Davis, 2010; Walker & Lloyd-Walker, 2014). This Australian model was then drawn on by those developing the Integrated Project Delivery (IPD) model in the United States in order to achieve a close collaboration between the owner and team of designers, contractors, and subcontractors (Levitt, 2011; Levitt et al., 2019).

The similarity of these approaches in response to “the appropriate way to organize” (Orr, Scott, Levitt, Artto, & Kujala, 2011, p. 29) suggests that there may be an isomorphic trend underway as individuals (consultants, academics, and managers), organizations, and institutions around the world copy and learn from pioneers of the new project delivery models. In this issue, Hall and Scott provide a fascinating account of how this process unfolded within the United States based on a case study of Sutter Health; at times we have ourselves seen glimpses of this process on a global scale. For example, when designing what would become the T5 delivery model, BAA was strongly influenced by the very same actors as Sutter Health—the Lean Construction Institute. And, more recently, the United Kingdom’s Institution of Civil Engineers has developed a collaborative delivery model called “Project 13,” (Infrastructure Client Group, 2017), which is now being applied on major infrastructure projects in Australia.

Infrastructure, Project Management, and Delivery Models

Having described the policy context and innovative efforts to create new and improved delivery models, it is now important to consider how infrastructure projects have been treated in the broader project management literature. Project management scholars have identified the distinct types of projects used to deliver large, complex capital investments in infrastructure, including “major projects” (Morris & Hough, 1987; Morris, 1994, 2013), “large engineering projects” (Millers & Lessard, 2001), and “global projects” (Scott, Levitt, & Orr, 2011). In recent years, the term “megaproject”—defined as projects with a capital cost of US\$1 billion or more (set at 2003 prices)—has become perhaps the most widely used category to describe large-scale infrastructure projects (Flyvbjerg, Bruzelius, & Rothengatter, 2003; Flyvbjerg, 2014, 2016; Merrow, 2011). Megaprojects are high risk, difficult to manage ventures. Large, complex infrastructure projects have earned a reputation for being mostly late, over budget, and failing to achieve their original objectives. In a well-known study of 60 large engineering projects, Miller and Lessard (2001) found that 40% of the projects were inefficient in terms of time, cost, and performance. More recent research on megaprojects found that 90% of projects have cost overruns of up to 50% (Flyvbjerg, 2014).

There is now a substantial body of literature that addresses the challenges of successfully managing the front-end development of large infrastructure projects. Debate exists about the root causes of these challenges and the explanatory power of different theories (e.g., Flyvbjerg, Ansar, Budzier, et al., 2018; Love & Ahiaga-Dagbui, 2018; Gil & Pinto, 2018) but, to date, the dominant theme has been that large infrastructure projects often fail because sponsors and clients systematically make poor decisions during the planning phase (Flyvbjerg et al., 2003; Williams & Samset, 2010; Merrow, 2011, Flyvbjerg, 2014). To reduce the risk of failure, scholars recommend that the sponsor and client shape the vision and governance structure to prepare for an uncertain future (Morris & Hough, 1987; Miller & Lessard, 2001; Merrow, 2011) and avoid behavioral biases associated with the tendency to underestimate the costs and overstate the benefits of a project (Flyvbjerg, 2006; Flyvbjerg, Garbuio, & Lovallo, 2009).

Perhaps because of the paucity of examples, surprisingly little research has identified the factors contributing to the *successful* execution—or *delivery*—of large infrastructure projects.

Instead, scholars have focused on identifying some of the key dimensions that make infrastructure projects so difficult to manage, including:

- The sheer size and scale of the task (Morris & Hough, 1987; Flyvbjerg et al., 2003; Merrow, 2011);
- The risks and uncertainty associated with their successful execution (Miller & Lessard, 2001; Floricel & Miller, 2001; Lenfle & Loch, 2010; Davies et al., 2017);
- The complexity involved in managing the design and integration of system and array projects (Shenhar & Dvir, 2007; Davies & Mackenzie, 2014; Brady & Davies, 2014);
- The urgency and pace of time within which projects must be completed (Morris & Hough, 1987; Shenhar & Dvir, 2007);
- A client's escalating commitment to a failing cause (Ross & Staw, 1993); and
- Aligning and reconciling of diverse and often conflicting public and private interests in multiparty projects (Henisz, 2002; Scott et al., 2011; Henisz, Levitt, & Scott, 2012; Kivleniece & Quelin, 2012; Levitt et al., 2019).

Another stream of research, which begins to unpack and identify what goes on inside the black box of megaproject delivery, recognizes that successful performance also depends on what happens during project execution, including forming a strong owner and capable leadership team (Merrow, 2011; Winch, 2014; Winch & Leiringer, 2016), developing new routines, practices and collaborative behaviors (Gil, 2009; Whyte, 2011; Davies et al., 2016; Tee et al., 2019), and establishing the capabilities needed to coordinate the design and integration of component parts of a complex system (Davies & MacKenzie, 2014; Brady & Davies, 2014). It is this shift that focused our attention on the management *models* used to deliver major infrastructure projects and how innovation was driving their evolution.

Conceptualizing Delivery Models

The word *delivery* appears with increasing frequency in project strategies, plans, and policy documents and is used by senior executives to describe how an infrastructure project will be organized and managed to design, construct, finance, and operate infrastructure projects. The term derives from the distinction made by clients, contractors, and consultants in the infrastructure sector between a *development* or planning phase and *delivery* or execution phase of a project. There was a shift in late 20th-century UK projects, such as Heathrow

Terminal 5, when clients spent more time carefully designing and developing a “delivery strategy” during the planning phase (Wolstenholme, Fugeman, & Hammond, 2008). As this practice has taken root, it has become increasingly common to hear practitioners then talking about the choice of “delivery model” to create and capture value throughout the life cycle of the project from execution to operational handover (Buck, 2018). Although this terminology conjures up a relationship analogous to that between business strategy and business models (Casadesus-Masanell & Ricart, 2010), there is much less clarity about what exactly constitutes a delivery model.

We see several different phases involved in the design, development, and enactment of a delivery model. The delivery model is designed and developed during a front-end *planning phase* when the sponsor and client define the overall strategic objectives or vision, shape the governance structure, secure financing, and prepare the contracting and procurement approach. An *execution phase* occurs when the project receives approval to proceed and contractors responsible for design, construction, integration, fit out, testing, and operational handover are employed to deliver the project. In some cases, the delivery model extends into an *operational phase* when a contract requires the provision of services to operate, maintain, and finance an asset over an extended period of time.

There are also different ways of designing the organizational, contractual, and governance structures that constitute a delivery model. For example, two main contrasting types of delivery models can be identified based on whether the client is a permanent or temporary organization. When a client is a permanent organization, such as BP, Shell, and the London Underground, the client is responsible for delivering multiple infrastructure projects over time. A permanent client as an opportunity and incentive to assemble the capabilities and routines required to deliver each project and use the learning gained to improve the delivery model used for subsequent projects. When the client is a temporary organization (Lundin & Söderholm, 1995; Sydow, Lindkvist, & DeFillippi, 2004; Grabher & Thiel, 2015) established to deliver a single project, such as the London 2012 Olympics, there is less incentive to develop capabilities and routines because the organization is disbanded on completion of the project.

It is not surprising that the concept of a delivery model has grown in popularity in the world of infrastructure alongside the widespread use of the term *business model* to describe how

firms are organized to create and capture value. Management scholars have developed in-depth case studies of business models created by firms such as McDonalds, Facebook, Disney, and Toyota to describe how specific organizations grow successfully by creating and capturing value. Used to classify different organizations, each model may represent an *exemplar case* of a particular type of behavior or a *type* against which other organizations following a similar model can be compared (Baden-Fuller & Morgan, 2010). Similar work has yet to happen in project management and we believe that the literature on business models can provide a useful starting point for conceptualizing delivery models.

Many firms involved in large infrastructure projects do have their own distinctive business models, such as Laing O'Rourke's model centered on being a vertically integrated constructor or Jacobs's, which is centered on a relationship-based model driven by long-term affiliations and alliances with repeat clients. The focus of a business model is on how a single firm continues to grow, prosper, and survive by creating and capturing value over time. A delivery model, by contrast, describes *how the multiple parties involved in a project are organized and managed to create and capture value on a one-time basis and disbanded when the task is completed*. Given this, project-based firms (e.g., Jacobs) and organizations (e.g., Highways England) might have multiple delivery models that can be deployed as part of their business model and broader organizational strategy (Casadesus-Masanell & Ricart, 2010). Although we define delivery models at the project level, we recognize that large infrastructure projects are frequently organized as a *program* of interrelated projects and clients (e.g., Anglian Water, the UK water utility) work with *delivery partners* to improve the performance of a program of distinct projects over time. Understanding how delivery models interact within a program will be an important topic for future research on delivery strategies.

Accepting that delivery models and business models are different, yet related, constructs is an important first step, but it is unlikely to produce interesting research unless we can agree on what constitutes a delivery model. In our discussions with scholars, senior executives, project directors, and managers, we have found that people often struggle when asked for a definition. It is one of those things about which people say: "I'll know it when I see it." Scholars can make an important contribution toward clarifying this discourse and distilling the concept to capture how value is created and captured for the project organization. Descriptions like *an alliance* or *through lean construction techniques, with a delivery partner, by partnering* or *using the Heathrow Terminal 5 Model*, each capture something

important, but on their own are incomplete. They are too abstract to provide recipes for organizational designers or too idiosyncratic for scholars to meaningfully characterize and compare the performance of different kinds of delivery models. Clearly we need a more nuanced and in-depth scholarly understanding of different types of delivery models and the consequences these have for performance. The contributions to this special issue take us a step closer toward this goal and, in concluding this essay, we draw inspiration from the articles to sketch out a series of building blocks we hope will further advance the field in this direction.

Contributions to the Special Issue

Taken together, the articles in this special issue paint a rich picture of what innovation in infrastructure delivery models looks like, the processes by which it is generated and evolves over time, and the consequences this has for organizations, institutions, and industries.

Daniel M. Hall and W. Richard Scott open our special issue with a fascinating study that unpacks the emergence and institutionalization of a new form of delivery model—Integrated Project Delivery (IPD)—in the United States. We learn of the importance of Sutter Health as an institutional entrepreneur, the conditions that enabled it to perform this role, and witness the various manifestations of IPD emerge as this innovation diffused. The article provides inspiration and insight into the organizational building blocks, institutional scaffolding, and processes future entrepreneurs might draw on to innovative delivery models in other markets or even at other points in time. As such, the theoretical framework deployed also provides a template for other scholars to advance our understanding of the topic through thorough comparative research. This sort of comparative work would greatly enrich our field, which has traditionally excelled at understanding (and influencing) the evolution of delivery models within a given institutional environment (e.g., Davies et al., 2009; Whyte, in this issue), rather than seeking to explore how variations across industries and countries might shape the evolution of delivery models and the way “discrete structural choices” are made between alternatives (Williamson, 1991, p. 270). By doing so, Hall and Scott’s article serves as an exemplary case of how the field of project studies can benefit from a closer engagement with institutional theories, as recently argued by Biesenthal, Clegg, Mahalingam, and Sankaran (2018).

The second article turns our attention from questions longitudinal and historical, to those of a more comparative nature. To do so, Espen Solheim-Kile, Ola Laedre, and Jardar Lohne draw on agency theory to frame a comparative study of Public-Private Partnerships (PPPs) in Norway. This article leverages rare access to contracts, participants, and stakeholders to problematize existing accounts of how PPPs create value for sponsors. Interestingly, they find that sensitivity to cost overruns made public sector actors more risk averse than traditionally assumed by agency theory. This insight helps explain observed risk transfers that existing theory would suggest are suboptimal and opens up a broader discussion of goal alignment between participants and how the characteristics of delivery models shaped this within their study. The authors' evidence points to the importance of understanding how informal governance mechanisms, such as relational contracting, interact with formal PPPs' governance mechanisms within a delivery model to shape project performance.

Lena E. Bygballe and Anna Swärd's article is third in our special issue and shifts our focus from broad conceptions of delivery models, and how they evolve and work, down to their enactment in the day-to-day practices of people within project organizations and what it takes to change them. This rich and insightful article draws on a longitudinal case study of a hospital construction project in Norway (2002–2014). The client, motivated by coordination problems experienced when using a delivery model built around traditional design-bid-build contracts, decided to create a more relational form of delivery model underpinned by the partnering approach (Barlow, Choen, & Jashapara, 1997; Bresnen & Marshall, 2000). The authors focus on the creation and destruction of organizational routines as a way of understanding how delivery model innovation happened in this setting. This approach brings to light the complexities of instantiating abstract notions—like Lean Construction—from a contract into the way work is actually done. The perspective the authors develop highlights the organizational *truces* (Nelson & Winter, 1984) that need to be built in order for coordination to be accomplished and the implications this process has for understanding how and when new delivery models are likely to succeed or fail. Given the temporary nature of projects, this way of understanding delivery model creation and institutionalization should provide fertile ground for future research and cause us to reflect on if and when we might see *truces* replaced by more permanent *settlements* between organizational actors (Rao & Kenny, 2008; Gann, Salter, Dodgson, & Phillips, 2012).

From practices, we turn our attention to technology with Jennifer Whyte's study of how digitization is transforming infrastructure delivery models in the fourth article in the special issue. Whyte's ability to draw on 15 years of in-depth, multilevel data collection spanning multiple projects and field-level initiatives in Britain provides us with rare insight into the way project-to-project learning shapes the evolution of delivery models. The novelty of this article can be found in the way Whyte systematically traces the shift from analogue to digital forms of information and carefully links this shift to the emergence of three different generations of delivery model innovation within the UK market. This focus on information is an important shift for literature that has, to date, focused mostly on aspects like contracts and culture (e.g., Barlow, 2000; Gil, 2009) when seeking to explain the emergence of new delivery models. Whyte's focus on digitization helps open up a new way of studying the sources of delivery model innovation and lays down markers for those seeking to codify this through taxonomies and typologies.

The fifth and final article in the special issue by Kent Eriksson, Kim Wikström, Magnus Hellström, and Raymond E. Levitt draws on an ecosystem view to build a heuristic framework for understanding the governance choices involved in delivery model innovation. There are many different ways to characterize business ecosystems (e.g., Autio & Thomas, 2014; Adner, 2017). Here the authors focus on workflows between actors involved in designing, building, operating, and using a new ship serving the short sea logistics market. The study is designed as a piece of action research and focuses on how different types of governance choices (e.g., introduction of an alliance) might enable whole of life costs associated with this industry to be reduced. The framework produced is highly flexible and should provide useful guidance for those seeking to better understand the nature of their project ecosystem when considering switching delivery models or embarking on efforts to innovate.

Future Research on Delivery Models

As editors, we have spent a lot of time talking about these articles and the broader topic of infrastructure delivery models. In doing so, we began to realize that each of these articles touched on a distinct, but interrelated, set of building blocks that could be seen as constituting a delivery model. These blocks ranged from the type of governance structure or organizational form selected through to the logic of value creation and capture. But those of us studying projects do not yet have a framework that brings together these various blocks

into a coherent whole. We see the challenge as analogous to that faced by scholars seeking to represent and understand business models (Baden-Fuller & Morgan, 2010). This literature offers a wide range of different ways of conceptualizing business models (cf. Mangematin & Baden-Fuller, 2015) and undoubtedly many could be applied to the phenomena of delivery models. There are several inter-related choices that one might use to dimensionalize a delivery model, such as:

- Client value drivers: speed-to-market, life-cycle costs, or cost certainty;
- Supply chain value creation mechanisms: design for manufacture and assembly or flexible engineering (de Neufville & Scholtes, 2011);
- Supply chain value capture mechanisms: pain-gain risk allocations, reputation accumulation, cost-reimbursement, or change orders;
- Governance mechanism: such as whether a shared-equity alliance, relational contract, or hard-money bilateral contract is used;
- Organizational design: such as whether the organizational structure is integral (Design-Build-Transfer) or modular (Design | Build | Operate);
- Technology: the use of BIM, augmented reality, artificial intelligence and other technologies to support design, construction, and operation; and
- Project management capability: such as whether this is developed in-house, augmented with external providers (e.g., a delivery partner, such as Bechtel) or fully outsourced.

The specification of a framework that might bring together these building blocks—such as a Delivery Model Canvas—is beyond the scope of this special issue, but we do see such typologies and taxonomies as a crucial step if future research is going to be able to generate a useful and empirically generalizable body of evidence on delivery models. This would help ensure that the subtle, but crucial distinctions between models are not lost when comparisons across time and institutional fields are being made. And it would also help ensure that the interdependencies (both positive and negative) that come with the combination of particular blocks into one delivery model can be adequately represented to both students, scholars, and practitioners. More broadly, we see such an advance as being a useful way for our field to replace generic descriptions of project organizations—such as *megaproject*—with something more meaningful. Without such a step, those of us studying delivery models are at risk of

ending up like the blind men in the parable of the elephant; each touching different parts of the elephant, but being unable to reconcile the whole.

By shining a spotlight on the phenomena of delivery models and its relevance to policy and practice across a wide range of settings and times, we hope this special issue will inspire more scholars to begin pursuing this important line of inquiry.

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