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Risk and innovation in projects: The case of alliancing

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Abstract: This research investigates the relationship between risk and uncertainty, and innovation in large-scale complex infrastructure projects. Looking at alliancing projects, which are known result in significant levels of innovative, we find that, on one hand, the goal alignment inhibits alliance members from off-load risk between each other. On the other hand, the goal alignment fosters a best-for-project mentality which, in turn, underpins the success of alliancing. In alliancing, innovation occurs not as an ends in itself, but rather as the means for participants to do what is best for the project in exceeding the projects goals. For practitioners, this suggests that the off-loading of risk may not always be desirable when one is seeking innovative and innovating solutions.

Keywords: Innovation; Risk and Uncertainty; Infrastructure projects; construction projects; Teaming; Risk management; Procurement.

1 Introduction and conclusion

This research responds to calls to investigate temporary project organisations in order to better understand the relationship between uncertainty and innovation; as exemplified by large complex infrastructure projects (Davies 2014). Complex inter-organisational projects are especially associated with uncertainty, and consequently there have been a number of studies into them (for a summary see Davies, 2013). Innovation and projects are also known to be closely interrelated (Davies, 2013), yet the need for innovation is a further source of project uncertainty. Somewhat contradictorily, Davies notes that research is largely silent on the relationship between innovation and uncertainty in these large complex infrastructure projects.

Our point of departure is that—given the impracticality to 'legislate' for innovation—strong goal alignment between the participants in the project facilitates increased levels of innovation. We argue that a focus on organisational processes and structures (Eisenhardt & Tabrizi 1995) is an insufficient explanation of innovation. We therefore need to examine the nature of the goals that are shared amongst the participants in temporary project organisations.

Empirically we draw on a single longitudinal case study of an engineering consultancy that participated in a number of alliancing projects. Alliancing projects are appropriate setting for this research because of their utilisation in situations where there are the high degrees of project complexity, uncertainty, and opportunity for innovation (Ross 2003). Our findings are used to show how a best-for-project approach arises from the goal alignment of participants, and from their inability to 'off-load' risk. It the 'best-for-project' orientation of participants that drives innovation in alliancing. The key contribution of this paper is that goal alignment is efficacious in temporary project organisation as it enables project goals which in turn leads to innovation occurring.

This paper follows the conventional structure. Section 2 provides the background on risk and uncertainty in large infrastructure projects with Section 3 reviewing temporary project organisations and alliancing as an approach to dealing with the aforementioned risk and uncertainty. Section 4 then addresses the issue of innovation in infrastructure projects, and particularly in alliancing. This is used to motivate our investigation into the drivers of success in alliancing projects, and the relationship of those drives to innovation. Section 5 describes the research design and methods together with the empirical setting of the research. The findings are presented in Section 6. Finally, the paper considers the contributions that emerge from the findings, and the implications for practice.

2 Risk and uncertainty in large scale complex infrastructure projects

Large-scale complex infrastructure projects are associated with high levels of risk and uncertainty (van Marrewijk et al. 2008). This can translate into cost overruns, missing completion targets, and even failure of the projects (Hillis 1997). Given the significance of risk and uncertainty in these projects, it is perhaps surprising that in much of the literature on large-scale infrastructure projects, the two concepts of risk and uncertainty are often conflated. Although Knightsian notions of risk such as the "probability that an adverse event occurs during a stated period of time", can be found (see, for example, the literature review by Edwards & Bowen 1998, p.339; Perminova et al. 2008), the term risk appears more frequently used to denote those "variety of situations involving many unknown, unexpected, frequently undesirable and often unpredictable factors" (Akintoye & MacLeod 1997, p.31); *e.g.*, the unknowable. The situation is such that the catchall phrase of 'risk and uncertainty' is often used when discussing either type of situation. Given the subjective aspects of risk and uncertainty (Perminova et al. 2008) it is unsurprising that practitioners also link the two terms. The NZ Transport Agency, for example, says that the "definition of risk is 'the effect of uncertainty on achieving objectives'" (NZ Transport Agency 2010, p.2). Similarly, the influential Project Management Book of Knowledge defines risk as "an uncertain event or condition that, if occurs, has a positive or a negative effect on at least one project objective, such as time, cost, scope, or quality" (Project Management Institute 2004, p.328).

The management of risk and uncertainty in a traditional—and simplified—infrastructure project normally occurs through risk retention, risk transfer, risk reduction, and risk avoidance (Akintoye & MacLeod 1997). Typically, risk retention and risk avoidance are seen as impractical or undesirable. Hence, risk transfer and risk reduction are the prevalent methods of addressing risk, with risk transfer being the most used approach. Risk transfer sees risks being moved "between client, contractor, subcontractor, design team, insurer and surety[i]" (Akintoye & MacLeod 1997, p.34). The contracting documents from the client usually has the responsibility for the risks being passed down the supply chain to the contractor (Lam et al. 2007). And so, many contractors "think of risk management as insurance management where the main objective is to find the optimal economic insurance coverage for the insurable risks" (Al-Bahar & Crandall 1990, p.534).

Approaches to risk reduction typically centre on contracts between the parties involved in the project—say, the client, the consulting engineers, and the contractors—that exactly specify what (and often how) the work will be done. The use of contracts, and through processes such as novation, leads to a degree of compartmentalisation and separation between those parties involved in the project. In other words, the scope of work for each of the parties involved is often precisely defined at the start of the project. The result of this tends to be a focus on getting projects done on time, within budget, and to the required quality standard (Randolph & Posner 1988); *i.e.*, meeting the contractual requirements or specifications. It is only lately that the additional goal of meeting the client's requirements has been added to that list (Pinto & Kharbanda 1995). Under such arrangements, innovation can be difficult to achieve given the nature of the contracts and procurement strategies employed by clients (Duffield & Maghsoudi 2013; Russell et al. 2006).

3. Temporary project organisations and alliancing

One of the ways of addressing the risk in large-scale infrastructure projects is by means of temporary project organisations. A particular form of temporary project organisation is the project alliance, which is also known as alliancing. Given the variety of delivery methods that might be adopted, what are the typical reasons that practitioners give for adopting alliancing? **Figure 1** shows that alliancing as being appropriate when scale, risk, and complexity are highest, and there is the largest requirement for innovation, flexibility, client involvement, together with significant programme constraints (timing, cost, standards, *etc*.). Yet, in alliancing the intention is not just to meet programme constraints but to come in under budget, and ahead of schedule, and without offsetting short-term goals against long-term (non-project specific) benefits (Ross 2003).

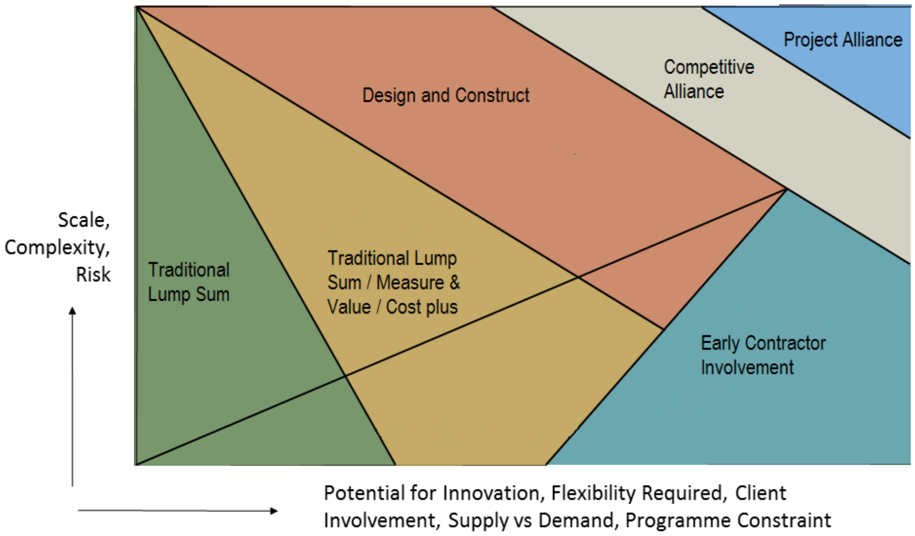

Figure 1 Delivery model selection diagram (Adapted from NZ Transport Agency 2015)

Alliancing can be seen as a specific procurement method[ii] with a concomitant form of contractual arrangement between the alliancing participants, together with a specific organisational form. In alliancing, two or more organisations come together with the client to create a new and temporary project organisation in order to deliver a complex and challenging project (typically within the realm of civil engineering).

Alliancing is somewhat distinct from strategic alliances. Waller (2013) notes that strategic alliances normally go beyond a single project; they are set up for an ongoing series of projects over an undefined period. In contrast, alliancing projects are relatively short-term and often have a well-defined point at which they are terminated (typically the 'practical completion' of the works). The contracts surrounding alliancing are well defined and similar in structure, whereas strategic alliance agreements are not necessarily based upon contract arrangements.

The principles of alliancing

The participants—the consortium of firms that make up the alliancing project—usually operate within a set of principles that are enshrined within the alliancing contact. A typical set are shown in **Table 1**. Broadly speaking, the principles and the underpinning contract demonstrate four things. First, there is an emphasis on doing what is best for the project; no one participant is allowed to put their firm's interests ahead of those of the project. Secondly, the decision-making is collective; each participant has a vote, they must use it, and decisions must be by consensus. Furthermore, they must live by the consequences of their decisions because of the gain/pain sharing mechanism; the pain/gain sharing model sees the benefits (or the losses) being shared amongst the participants depending on "how the actual project outcomes compare with pre-agreed targets that they have jointly committed to achieve" (Ross 2003, p.1). Thirdly, and of particular interest to this research, participants are unable to lay-off the risk—they can neither blame other participants nor enter into litigation or arbitration with other participants. Thus, participants are unable to use risk transfer as a means of managing risk. Rather risk is handled in an entirely different manner. The gain/pain sharing model means that the alliance partners win or loss as a collective, and consequently there is no incentive for them to try to transfer risk amongst participants. The result is that risk is effectively shared between the participants (Sakal 2005).

Table 1 The typical principles in operation in an alliancing project.

Principle	*Contractual mechanism*
All alliance participants have an equal say	Each participant has one vote (including the client) and must use it
Agree accountabilities and responsibilities together	Decisions must be by consensus.
Determine what is "best-for-project" when making decisions	Individual firms are not allowed to put their own interests ahead of the project's
Operate with no-blame between participants	There is to be no arbitration or litigation between participants
Do business on an open-book basis	The contract allows for an external auditor to ensure this occurs
Deliver results where we all win or lose together	Gain and pain sharing applied equally to all participants
Accept collective responsibility knowing there is a fair share of risk and reward	Specific clause in the contract
Accept responsibility as an alliance but deliver on individual accountabilities	No rights, obligations, or interests can be assigned by participants with the consent of the other alliance partners
Be open and honest with each other	Specific clause in the contract
Obtain unconditional support from top management	Specific clause in the contract
Resource the alliance to deliver high performance	Specific clause in the contract
Promote innovative thinking to achieve outstanding results	Mechanism not specified in the contract.

However, whereas most of the principles are underpinned by contractual requirements, innovation is not explicitly embedded in the contract other than through the notion of "best use for money".

The alliancing contract normally provides for a three-tiered organisational structure of the alliancing organisation. At the apex there is the project alliance board (PAB). The PAB ensures the delivery of the project and comprises senior representatives from each of the participating organisations. Members of the PAB are in many ways part-time members and may sit across multiple project. Underneath the PAB is the project management team (PMT). The PMT is responsible for the day-to-day management in the alliancing projects and is lead by an Alliance Project Manager. Below the PMT are the alliance members drawn from the participating organisations.

The outcomes of alliancing

In his analysis of alliancing in Australia, Ross (2003, p.17) notes that "on most of the alliances completed to date the actual outturn cost has been below the agreed target outturn cost"; *i.e.*, they have come in under budget. Likewise, in terms of 'on time delivery', alliancing "has consistently been outstanding, with many finishing months early despite enormous challenges and obstacles along the way". Furthermore, "performance in other areas has ranged between best practice to outstanding". In reviewing the performance of alliancing in New Zealand, we find similar results, as shown in Table 2. Barlow (2000), provides further examples of the variety of positive outcomes from alliancing through a detailed description of the benefits that accrued to the Andrew Alliance—BP's original alliancing project in the North Sea. Aside from the outcomes already mentioned, these included the halving of accident rates, improved technical and business processes, a material reduction in the number of drawings that were required, and so on.

Table 2 Summary of NZ Transport Agency alliancing projects

Project name	*Start and End date*	*Cost (NZD)*	*Under budget*	*On time*	*Evidence of innovation*
Waterview Connection	2013–2017	$1.4bn	On-going	On-going	Yes
Manukau Harbour Crossing	2008–2010	$235m	Yes	Yes	Yes
Victoria Park Tunnel	2009–2012	$340m	Yes	Yes	Yes
SH16 Causeway	2013–2017	$100m	On-going	On-going	Yes
Newmarket Connection	2008–2012	$215m	Yes	Yes	Yes
Grafton Gully	2002–2004	$67m	Yes	Yes	Yes

Source: Andrew Gibson. Unpublished dissertation, 2012

Authors including Ross (2003, p.20; Chen et al. 2012; Duffield & Maghsoudi 2013) also report that alliancing "typically delivers extraordinary levels of innovation". To appreciate that statement it is fitting for us to consider innovation in infrastructure projects and innovation in alliancing.

4 Innovation in infrastructure projects

Following the seminal work of Crossan and Apaydin (2009, p.2), we take innovation to be the:

> "production or adoption, assimilation, and exploitation of a value-added novelty in economic and social spheres; renewal and enlargement of products, services, and markets; development of new methods of production; and establishment of new management systems. It is both a process and an outcome".

Given the focus of our research, framing innovation as a process is particularly apposite as it centres the drivers and sources of innovation.

Table 3 The drivers and inhibitors of innovation in engineering projects

Category of drivers and inhibitor	Driver or inhibitor of innovation
Project specific characteristics	Project type
	Project scale
	Project complexity-uniqueness; *e.g.*, the uniqueness of the project may mean a lack of prior experience and fewer solutions
Commercial and business factors	Responsibility integration
	Nature and composition of project team
	Opportunity for similar projects
	Source and extent of competition
	Number of competitors
	Proposal evaluation criteria
Project requirements	Project performance requirements
	Requirement for socioeconomic benefits
	Statement of product solution
	Statement of process solution
	Penalties for inadequate performance
Project risks	Product risks
	Process risks
	Natural environment risks
	Reasonableness of assigning risk
Socioeconomic and political considerations	Certainty of economic environment
	Certainty of political environment
	Certainty of regulatory environment
	Certainty of stakeholder environment

Source: Based on Russell, Tawiah and De Zoysa (2006)

In their review of the literature on project innovation, Russell, Tawiah and De Zoysa argue that there are 22 main factors that can either drive or inhibit project innovation (Russell et al. 2006). They group these drivers in five major categories being: project-specific characteristics, commercial and business factors, project requirements, project risks, and socioeconomic and political considerations as shown in Table 3. Of these five types, project risks and socioeconomic and political considerations are both forms of risk; the former largely concerned with risks within the project and the latter concerned with risks in the external environment. The commercial and business factors primarily address matters of competition, and the project specific characteristics and the project requirements are inherent in the project itself. That being said, one might wonder what are the key drivers in infrastructure projects?

In their review of the literature, Blayse and Manley (2004) argue that there are six key drivers of innovation in these type of projects. First, clients can foster innovation, say, by specifying novel requirements. Second, the structure of production, which limits the opportunity to transfer knowledge, and by creating isolated and independent packages of work further limits innovation. Thirdly, the temporary relationships or loose-couplings that frequently occur in infrastructure work against innovation. Fourthly, procurement systems, that usually privilege “speed and urgency, or on competition on the basis of price alone” (2004, p.148) further impede innovation. Fifthly, government regulations and standards are found to hamper innovation. Finally, and perhaps most importantly, organisational resources are seen as being the largest lever for innovation and one that is generally in the control of individual organisations—as opposed to being a consequence of system-wide issues. Even when thinking of the clients, organisational resources in the shape of technological competency allows them to demand more innovative solutions. As a result, for firms involved in infrastructure projects that seek to be more innovative, there is an emphasis on a team integration, cultures that are innovation friendly or that support collaboration, and the development of absorptive capacity.

Overall, these highly uncertain and novel projects, such as those associated with large complex infrastructure projects, are known to require adaptive, flexible, and real-time learning processes (Eisenhardt & Tabrizi 1995). Furthermore, they require appropriate cultures (Barlow 2000) and organisational structures (Doherty, 2009)—including team integration (Ibrahim et al. 2011). Temporary structures are well suited to promoting innovation (Bennis and Slater, 1968) and the project form of organisation is well suited to performing the complex tasks when a unique product, such as a large infrastructure solution, is required (Davies and Frederiksen, 2010).

It is generally accepted that infrastructure projects exhibit relatively low levels of innovation, especially when compared to the manufacturing sector (Veshosky 1998). This seems to be true despite those within their industry seeing their projects as being “inherently innovative, involving problem-solving under unique conditions” (1998, p.58). The restricted level of innovation in this arena is often attributed to the fragmented structure of the industry, the uniqueness of the projects, and the tendency for the R&D capability to be located in universities or in suppliers to the industry (Blayse & Manley 2004). The nature of the procurement processes is also of particular note as it often acts as an inhibitor of innovation. In the traditional lump-sum contract, for example, payments to contractors (suppliers) are made upon completion of set stages in the project. Consequently, contractors are encouraged to work efficiently to complete the stages on time, rather than to focus on innovations or on changes in the project’s scope; such changes would necessitate revisions to the contract which itself might delay the project and thence delay payments. As a result, contractors often prefer to use tried and tested methods that they know will allow them to complete the tasks within the contracted timeframe (Barlow 2000). Priemus, Flyvbjerg, and Wee (2008) frame this as a preference for proven technologies rather than innovative technology.

Innovation in alliancing

Innovation is often seen as one of the main reasons why alliancing is selected to deliver projects (Ibrahim et al. 2011). This is because a significant number of alliancing projects resulted in innovation and innovative ways to perform various aspects of the project. Subsequently, alliancing innovations are often utilised by the participating firms outside of the alliancing project that was the source of the innovation (Hauck et al. 2004).

The lack of risk ‘off-loading’ and the gain/pain sharing arrangements means that it is in the best interests of participants to do what is best for the project (Hauck et al. 2004; Walker et al. 2013). For example, experts from across participant organisations are more likely to collaborate to address and solve problems when they arise (Barlow 2000; Ibrahim et al. 2011). Consequently, they can produce solutions that have never been thought of before, or solutions that are unique to a specific project and —supported by the alliancing team to fix any issues with the solutions—the success of such innovation is much higher (Walker et al. 2013). Furthermore, as noted teaming, is vital in promoting innovation as it fosters a collaborative culture. Consequently, in alliancing teaming often becomes a key performance indicator (Ibrahim et al. 2013).

Research question

This leads to our research question. Despite the risk and uncertainty associated with large-scale complex infrastructure projects, alliancing produces outstanding outcomes across a range of measures (*e.g.*, cost and timeliness). So, what are the drivers that underpin that success in alliancing, and what is the relationship between those drivers and the innovation that occurs because of alliancing?

5 Research design and methods

This exploratory research is based on a single in-depth longitudinal qualitative case study of an engineering consultancy over a fifteen-year (real-time) period. Somewhat opportunistically, the research project is one of several research projects conducted with this firm over that period. Over 100 interviews, 400 hours of observation of meetings and events, and seven 5-day long 'shadowing' of individual participants took place across four countries. Participants included three chairs of the firm, managing directors, general managers, project directors, project managers, business-unit managers, business development managers, engineers at all levels of the firm (including those who were employee shareholders), non-professional staff (*e.g.*, from marketing and HR), clients, and others from firms with whom the focal firm collaborated. This resulted in several 'slices' through the organisation. In addition, we also followed some projects in which those participants were engaged. These included both client projects (*i.e.*, engineering projects; both alliancing and non-alliancing) and internal development projects (*e.g.*, leadership development projects). More specifically, to this research question, the corpus of data collected included information on three alliancing projects and included follow-up interviews with specific participants for additional data on alliancing.

In addition to the primary data, an additional 10 years of prior secondary (archival) data was collected from the firm. We augmented this by further secondary industry-wide data. Thus, the data set covered 25 years of the consulting firm’s activities.

Data analysis

Given the exploratory nature of the research, the data were analysed using thematic analysis (Eisenhardt 1989; Miles & Huberman 1984; Pettigrew 1997). We thereby used a form of sense making that is well known for its applicability when utilising qualitative data (Langley 1989), and following recommendations in the literature, commenced the analysis by initially reducing the volume of data through categorization, building abstractions, and developing individual properties (Miles & Huberman 1984). This process was facilitated through the use of Atlas/ti, a software program for the analysis of qualitative data, as recommended by (Yin 2003).

The empirical setting

The focal firm of this research—that, for the purposes of this article is called ConsultCo—is an international engineering consultancy that has been a consortium member (*i.e.*, an alliancing participant) in the majority of the alliancing projects in New Zealand. Unlike specialist engineering consultancies—that might be subcontracted for particular expertise in, say, tunnelling—ConsultCo is usually the lead engineering consultancy in the alliancing projects in which it participates. Consequently, ConsultCo has a significant experience in alliancing, and many in the field regard the firm as having particular competencies around alliancing. This is illustrated by the fact that, rather unusually, a significant number of engineers from ConsultCo have held multiple roles in multiple alliancing projects. For example, one engineer has had roles as an ordinary engineer, a PMT member, as an Alliance Project Manager, and as member of a PAB. In total, that engineer has also participated in five separate alliancing projects across two countries.

6 Findings and conclusion

We find that goal alignment underpins the efficacy of alliancing in meeting the projects goals; *e.g.*, of cost, time, innovation, *etc*. More precisely, the goal alignment that the alliancing contract drives results in a significant change in how risk is considered and mitigated with the alliancing project, compared to more typical infrastructure projects; *e.g.*, the inability of alliancing members to be able to shift risk to clients, suppliers/sub-contractors, or to other members of the alliancing project. Instead, the form of goal alignment in alliancing establishes an environment in which the alliancing participants equally share the consequences of risk and of performance. In other words, alliance partners lack incentives to off-load risk.

In turn, this drives the best-for-project mentality—that is a prevalent theme in the practitioner literature on alliancing—and through which the cost, time, quality, *etc.* goals are not only met but to be surpassed. Other characteristics of alliancing that foster innovation, such as 'teaming' and the organisational structure of alliancing, management support, are important but without the aforementioned goal alignment, those other features would be less effective.

Of particular note, we find that it is the innovation that occurs in alliancing is not an ends in itself, rather it is the response by participants to solving the problem of “How can we provide breakthrough results, to deliver what is best-for-project?”. This outcome stands in contrast to the notion that it is the teaming, culture, and so on, that drives innovation.

This research makes three contributions. First, prior research has shown the impact of risk of risk and risk management on innovation (for example, Brown and Osborne, 2012; Mu et al., 2009). We extend that literature, by showing how the contractual arrangements between the firms in alliancing project creates goal alignment that, by inhibiting the offloading of risk, results in a best-for-project mentality.

Secondly, we show how other well-known behaviours that promote innovation flow from this best-for-project position; *e.g.*, the deep involvement of the client, teaming, organisational structure, and innovative culture.

Finally, we find that 'best-for-project' culture that arises in alliancing and the subsequent 'innovation behaviours' result in higher levels of innovation than might otherwise be expected from alternate contracting arrangements.

Implications for practice

The manner in which firms address risk in project contracts can have significant implications for the innovation that might flow from projects. In complex, uncertain, and large—many hundreds of million dollar, or even billion dollar—projects, the risk exposure to the parties involved can be significant. The desire to minimise ones exposure is normal and natural. However, this research finds that minimising the project participants' cross-exposure to risk also constrains the project's potential to deliver innovation. More fully, whilst the participants in alliancing may seek to reduce risk, this should not be done by transferring risk to other project members. This is possibly a counter-intuitive implication of the research

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[i] A surety, or surety bond, is a form of guarantee. It is not a form of insurance, *per se*.

[ii] Procurement is concerned with the process of selecting suppliers, establishing payment terms, the vetting of suppliers, selection of suppliers, the negotiation of contracts, and the actual purchase itself.