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Delivering a water treatment plant project using a collaborative project procurement approach

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Abstract

Purpose – The purpose of this paper is to explore an interesting complex infrastructure construction case study project in which the initiation/design and delivery phases were managed differently, with diverse assumptions and workplace culture. It uses a recently developed collaboration and relationship-based procurement taxonomy to analyse the decision to commence a project and to deliver the project. The taxonomy tool reveals underlying assumptions and helps explain actions taken. The paper provides a window into the decision-making process. It also illustrates levels of innovation applied at the design and delivery phases.

Design/methodology/approach – A case study was undertaken, primarily using recorded and transcribed interviews, with five key senior participants in the project. This gathered a client, designer and contractor perspective that was subsequently analysed using a sense-making approach.

Findings – It is possible to start a project adopting a highly collaborative approach that maximises innovation, understanding complexity and developing a design that can then be delivered using a more traditional approach. The taxonomy used demonstrates that it is a useful visualisation tool for this purpose.

Research limitations/implications – The research was limited to the perspectives of only five individuals even though they were key decision-makers and had a robust overview of the project as a whole. The delivery phase was chosen as a matter of policy without the ability to break loose from that policy. The implications for beginning the initiation and design process in a highly collaborative hands-on mode influenced the understanding of all parties involved in the project in a positive direction. The case study was based in Australia, which has extensive experience of collaborative project delivery approaches.

Practical implications – The taxonomy and its ability to provide visualisation of the experienced collaboration presents a powerful tool in helping us understand how it may be useful and what limitations to collaboration exists.

Social implications – The paper illustrates the value of social interactions as alliance forms tend to consider triple bottom line issues and stakeholder engagement more highly than traditional, transnational approaches to project design and delivery.

Originality/value – The case study was unusual in its technical complexity; however, the main value of the paper is the application of the taxonomy and visualisation tool as a way to better understand how a project is being managed from a collaboration perspective.

Keywords Briefing, Infrastructure, Design and construction, Construction management, EPC, Alliancing

Paper type Research paper

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Introduction

A serious problem facing teams that deliver complex projects is their ability to attract and coordinate the best available minds and ideas to deliver innovative design solutions that optimise project delivery outcomes. Procurement choice decisions have much to do with addressing this problem. The project reported upon in this case study is from Australia where three-way collaborative experience of project alliances is extensive. Thirty billions dollars' worth of projects have been delivered in Australia over the past decade or two (Department of Treasury and Finance Victoria, 2010).

Collaborative three-way approaches, in which the project owner (PO), the design team and the contractor provide intellectual and practical input at an early stage of the project have been shown to be superior to the traditional project delivery approach in prompting innovation to achieve more effective project outcomes (Morwood *et al.*, 2008). A prerequisite of intimate collaboration of this type requires open communication, trust and commitment between the design consultant and contractor through early contractor involvement (ECI) and where the PO takes an active and knowledgeable role in the collaboration.

Relationship-based procurement (RBP) approaches present a continuum of mutual commitment of project parties; however, a wide range of project delivery choices presents a dilemma because a balance has to be struck between the aims and aspirations of project delivery participants and constraints presented by the project context. Understanding the demands and features of various RBP options assists in practically guiding a decision on choosing a collaboration approach. Most RBP research has focussed on integrated collaboration of the PO, design team and contractor across the *design and delivery phases* of construction projects (Lahdenperä, 2014), whilst scant attention has been paid to research that may illuminate how the dynamics of close three-way collaboration takes place in which the nature and intensity of this collaboration changes between the *design and delivery phases*.

However, Walker and Lloyd-Walker (2015) and Morwood *et al.* (2008) observed from a series of RBP studies that some clients may start the design phase using a design alliance (DA) engagement form and then re-visit their project delivery options after substantially finalising the design and understanding the likely project constraints and opportunities. However, it is unclear why or how this occurs or what dynamics trigger collaboration decisions at any/all phases of a project.

Research questions that addressed this issue are:

RQ1. What influences the decision to commence a complex project in a highly collaborative manner during the design phase and to then switch to a lower form of collaborative engagement during the delivery phase?

RQ2. What impact, if any, might this decision have on project delivery collaboration?

Questioning which RBP choice was made for case study projects provides an opportunity to examine *how* policy, situational practicality and a range of technical and relational factors may influence an optimal project RBP choice. The research focused on collaboration across both *RQ1* phases of the project delivery. Therefore, a unique case study was chosen to investigate the particular project delivery choice taken across its design and construction phases and to analyse the rationale for the adopted project procurement choice taken.

Research approach and methodology

The research aim was to unearth insights about the rationale for choosing a particular form of team collaboration that was used at the *design* and later at the *delivery* stage of a complex project and how that choice impacted upon the effectiveness and quality of collaboration throughout the project delivery. According to Yin (2014), these questions are best answered using qualitative research methods using experts providing insights into their rationale for action within a specific context. Interpretation and explanation of insights requires taking a constructivist ontological stance referencing relevant theory and literature. Experiences of interviewed experts' are socially constructed "realities". They do not exist in isolation, but are formed by perception of the context that these experts find themselves in (Klakegg, 2015; Mingers, 2003). A case study approach was chosen as the most appropriate research approach to be explored where interviewed experts were embedded within the project context. The data comprised experts' experience of making their adopted procurement choice. The nature of collaboration that was adopted formed the unit of analysis. A recently developed taxonomy provided an analysis framework. The epistemological stance was based on interpretation through dialogue conducted by interviewers and experts using a semi-structured instrument. This provided opportunities for "truth" about interviewees' perception of their experiences to emerge. The authenticity of the experts providing the raw data was trusted. They were immersed in, and lived, their reality of the case study project. These key actors were chosen because they had extensive industry experience across a range of projects and were best able to fathom what was occurring between the actors in the case study project. Thus, a pragmatic axiological approach was pursued, as recommended by Biedenbach (2015).

The case study was selected because it provided an example of a complex project being commenced as a three-way DA between the PO, design team and contractor, providing ECI in which procurement choice was then changed to an engineering procurement and construction (APC) contract. This presented a rare case of a change in procurement strategy that offered insights into project collaboration and procurement decision-making on the same project across two project delivery phases.

Research on alliances undertaken within Australia and New Zealand has mainly focussed on quantitative studies (Walker *et al.*, 2015; Wood and Duffield, 2009). However, qualitative studies of alliancing have also been published in Australia and elsewhere (Davis and Love, 2011; Laan *et al.*, 2011; Walker and Lloyd-Walker, 2015). Case studies of DAs are rare (Alliancing Association of Australasia, 2012). Additionally, the study by Walker and Lloyd-Walker (2015) provided a useful taxonomy of RBP elements and characteristics that could be used for sense-making about the nature of collaboration. It also provided a visualisation tool that proved helpful in benchmarking the degree and extent of collaboration for various project delivery forms. This tool was considered useful in exploring and answering the research questions.

This case study had emerged from the research team work conducted under the Walker and Lloyd-Walker (2015) study. The main output from that study was a book, which provided a taxonomy that could be used to characterise relationship-based forms of procurement under 16 identified elements. Two researchers from that team interviewed five senior participants in that study (Table I). While the data gathered from the transcribed interview were useful to create and develop the taxonomy, it also

Ref.	Role	Notes and comments
P29 [PN]	General Manager of the Water Corporation	Had a strategic view of this case study as part of a large infrastructure delivery programme with an overall responsibility for the entire business
P31 [SC]	PA manager and PO Representative (POR) throughout both design and delivery phases	Had a strategic and early involvement operational view being involved at the early stages of the design stage. He was the POR for the project at the early stages to establish the procurement arrangements and reporting to P29
P35 [MP]	Construction Manager, for the ECI design phase and later for the delivery phase	Was involved in the project design and then led the EPC delivery phase. The project followed a stage-gate approval process in which an initial project solution was cost estimated. Tenders were called for the role of EPC contractor once the "go" decision was made. ConC won the tender against other contracting bidders and he continued as project manager at the delivery phase
P36 [PM]	Design Manager at the early design stage	Was involved at the early stages of design as part of the service alliance as Design Manager but not involved at the project delivery stage
P49 [DdK]	Design Manager at the project delivery stage	Was involved at the early stages of design as part of the service alliance as Design Manager and then through the project delivery stage

Table I. Interviewed project participant details

provided an opportunity to test the taxonomy after its development as a form of piloting how the taxonomy may be applied in practice.

Case study details

This case is rare and provides valuable insights from several complexity perspectives. First, it was a project with two distinct and separate POs who had formed a quasi-joint venture to deliver the project. One party was a government instrumentality (a water authority) and the other a multi-national oil company. This presented organisational complexity due to culture diversity and how these two entities worked together with very different core values, operational styles and accountability to their organisational owners.

The AU$94.2 million project was funded from three sources: the regional water authority (AU$17.5 million); the oil refinery company (AU$47.5 million) and a state government (AU$9.2 million). These organisations had different governance requirements that added to project complexity. The water authority had experience of alliances, while the oil refinery company's head office had outlawed the use of alliancing and only permitted a narrow range of more traditional project delivery approaches. The state government had experience of a whole range of project delivery approaches; therefore, it neither imposed nor denied any particular project delivery form. Second, the project was technically complex. There was also tension between the two POs' host organisation governance requirements for passing the project through a stage-gate process. Decision-making processes about how the project should be delivered from inception to preliminary design to bid and then delivery was quite different for each owner party. The result was a very rich contextual set of project delivery circumstances.

The initiation of the project was based on a common goal of both POs for water conservation during a 14-year drought that threatened the community and the industry's viability. The water authority and major oil refinery company decided to *jointly* develop a new water treatment facility that would process town sewerage and waste water along with industrial waste water generated by the refinery plant. Each party, together with the state government, agreed to contribute to the project's development and that the water authority would own and operated the facility. The oil refinery company had a global policy of stage-gate decision-making (Cooper, 2005) at the proposal, concept design, detail design and construction commitment decision points with a commitment to using an engineering procurement construction (EPC) project delivery approach. The water authority and state government were not averse to this process and so the insistence on an EPC project development approach was adopted.

The plant was to deliver potable water quality. Treating a mixture of industrial as well as town and residential waste water presented a number of technical uncertainties about the optimum treatment technology to be used and how it would function. This required iterative modelling of various innovative options. The water authority had sufficient experience and expertise to manage the project management process of the design solution and tender work package preparation with design advice and input from the contractor. The initial cost estimation was in excess of that budgeted for and so the final design solution to reach an acceptable capital expenditure was arrived at after numerous value engineering workshops. Collaboration between the parties enhanced the process of reaching a committed budget. Tendering of the lump sum work packages and the contractor's management fee was undertaken using a transparent process. The project's final cost at AU$94 million occurred as a result of significant front-end and design stage collaboration. Project delivery followed two phases. Phase 1 adopted a collaborative DA model followed by a construction Phase 2 undertaken based on a lump sum price EPC basis.

Design Phase 1 comprised collaboration between a PO consortium, a specialist design consortium and a contractor. The main PO entity was a water authority (PO-A) and the second PO was an oil refinery organisation (PO-B). The specialist design consultant (SDes) comprised a lead design group (SDes-1) and a small specialist advisor team (SDes-2). The construction contractor organisation (ConC) had also been heavily involved in establishing and working within a programme alliance with PO-A. Consultancy input by both the design and contracting parties was based upon agreed hourly rates using co-located facilities funded by the PO consortium.

The water authority had a programme alliance arrangement in which it collaborated with ConC and a different specialised design consultant. Appointment of SDes-1 and SDes-2 was based on an estimated number and cost of time (hourly rates) proposal with the PO paying for other direct costs. Similarly, appointment of ConC was based upon agreed hourly rates and estimate of number of hours. The water authority was able to benchmark hourly rates from their experience of programme alliance establishment as well as from previous experience of recent similar projects. The scope of Phase 1 work was to design the facility, estimate capital and operating costs to optimise the life cycle costs, seek and obtain statutory approvals and undertake the necessary stakeholder management for internal project stakeholders as well as for community and other external stakeholders.

The project gained at least one industry award as a DA for Phase 1 and there were also publications from the water authority PO and community information about the project that provided additional documented contextual background information to the project that the researchers drew upon.

Case study interviewee details

Five subject matter experts were interviewed who were instrumental at the senior level at the design and delivery phases and were holders of the most reliable data about that project that could be found. Each interview was semi-structured with questions to illicit a response, allowing measurement of each of the collaboration taxonomy's 16 elements. Table I provides details of the interviewees. Each interview took approximately 1 hour, was semi-structured and was recorded and then transcribed. This yielded approximately 60 transcription pages.

The taxonomy developed by Walker and Lloyd-Walker (2015) was used by the researchers to make sense of the interview transcripts and to map elements of collaborative capacity. The taxonomy is explained in the next section in greater depth. The advantage the taxonomy was that it could be used to assess and map collaboration features of the case study project using well-developed measurement scales. This case study was useful in testing the efficacy of the tool. The researchers mapped the collaboration contributing elements by analysing and coding the transcripts based on the 16-taxonomy element structure. Values between low = 1 and high = 5 along each taxonomy dimension were attributed from the anchor-point descriptors suggested by Walker and Lloyd-Walker (2015). Once these were mapped, an interpretation of their meaning was made to help answer the research questions. A draft of this exercise was written up by the researchers and sent to the interviewees to review and comment upon.

Best practice would suggest that element rating should be undertaken collectively by subject matter experts familiar with the project and its context at a workshop with them all agreeing each element's rating through discussion and consensus. One weakness in this case study's approach has to be acknowledged. The researchers undertook the rating based on data gathered and then sent to the five respondents for comment. Only P31 responded in depth; however, he advised that the taxonomy rating seemed to reflect the project well. It would have been preferable to have gathered the participants together for a workshop to discuss the results and implications more fully, yet that proved elusive. Therefore, the results can be seen as tentative, nonetheless useful. The taxonomy tool proved beneficial as a means to elicit insights and to provide a framework for making sense of the transcript and provide a structure for illuminating interviewee quotes. The case study was also useful in piloting the taxonomy's application.

Theoretical framework

To answer the research questions, two theoretical lenses were applied together with a recently developed sense-making tool. The paper's focus is on projects that can be categorised as being complex; therefore, this case study needs to be justified from a complexity theory stance. Secondly, the research questions are about the nature of collaboration within a complex project environment so insights from the literature on collaboration in this domain would benefit from lessons from the literature on integrated project delivery. The purpose of collaboration in response to dealing with complex projects was to find innovative solutions and processes to deal with unexpected and

unforeseen problems. Reference to the innovation-through-collaboration literature helped frame the discussion and analysis. Finally, the tool chosen for making sense of the data need to be explained so the RBP taxonomy is briefly described below to enable the logic of its use to be understood.

Dealing with complexity as a trigger for collaboration

Taking a transaction cost economic perspective on various construction project delivery approaches under varying contexts, Sweeney (2009) concluded that complex projects require intense collaboration between the various parties responsible for their design and delivery. There are a large number of "unknowns" that need to be addressed. However, traditional construction industry design-bid-build approaches and even design and construct approaches often fail to marshal available talent, knowledge, experience and contextual insights to produce the desired project outcome. Traditional information/knowledge and power asymmetries are characterised by adopting a dominant product logic rather than a service logic (Lind and Borg, 2010). Sweeney (2009) demonstrated that these asymmetries contribute to wasted energy and money during the project briefing, design, procurement and delivery project phases. A service perspective increases value generation by project parties focusing on a best for project outcome derived from close collaboration between project delivery teams. This focus frequently delivers innovation in a product, service or process (Lim and Ofori, 2007; Manley and Mcfallan, 2006; Slaughter, 2000). Innovation is often triggered by deep and effective levels of collaboration involving empathy (Leonard and Rayport, 1997).

Unique and challenging situations faced at the front end phase of many public infrastructure construction projects can range from the complicated to the complex. Complicated situations can be contrasted to complex ones. Snowden and Boone (2007, p71) argued that "Complicated contexts, unlike simple ones, may contain multiple right answers, and though there is a clear relationship between cause and effect, not everyone can see it". For complicated contexts, there may be one right answer; nevertheless, for complex contexts, it is often impossible to know if there is a correct answer because the situation is dynamic with highly related parts within the system and between the system and its boundary systems. Interactions pose problems of perceiving cause and effect loops due to the dynamic nature of the context. Complexity can be derived from technological interactions such as having many dynamically inter-related parts; however, it also can be derived from human behavioural dynamics through shifting allegiances, purposeful or inadvertent withholding of vital information or knowledge or unpredictability of action or inaction (Remington, 2011). The case study project was complex from several perspectives. Dealing with complex situations require reflexive, versatile and resilient team member behaviours and innovative problem-solving skills (Remington, 2011).

The design and construction of the sewage and waste water plant was technically complex because it combined inflows from general town sewage effluent with oil refinery industrial waste. This added novel technical dimensions of complexity. Chemical and biological interactions were largely unknown, so this presented a need for fresh thinking about what design solution to adopt to choose as the most effective and efficient treatment technology. One indicator of a technical complex situation is that it requires experimentation and iterative responses because solutions are not obvious or

previously known. Solutions emerge as part of a purposeful process of trial and error discovery (Leonard and Rayport, 1997).

An innovative approach to this project was also required due to human behavioural complexity and this presented a tension for each PO party about which organisational norms, culture and decision-making processes should be adopted. PO-A was accustomed to participating in alliance projects, while PO-B was constrained to delivering projects using a highly competitive EPC form of project delivery. PO-A perceived its major stakeholder to be the community, while PO-B's local management perceived its major stakeholder to be its shareholders and corporate head office staff. Thus, the project delivery approach had to navigate technical, contractual and human behavioural complexity dimensions.

Categorisation of collaborative integrated project delivery approaches

There has been growing recent interest in research into categorising various forms of integrated project delivery that range in intensity and intimacy of collaboration and levels of fragmentation of design and delivery (Masterman, 2002). Attempts to provide a standard set of meaningful terms or categories for various forms of project delivery use a variety of core and peripheral elements that may describe or provide a visualisation of this ephemeral goal of definition.

Turner and Simister (2001) mapped contract types across four dimensions: uncertainty of the product, complexity, ability of client to contribute and uncertainty of process. Others explain collaboration towards an integrated project delivery form in terms of categorising trust through partnership arrangements as a core element. Eriksson (2010) provided a study of trust and collaboration between designers and contractors in Sweden. Others illustrate how deep collaboration can occur and how it can be so successful in delivering innovation on complex projects to a range of highly exacting success factors through triggering innovation. The Heathrow Terminal 5 approach provides a valuable illustration of this (Doherty, 2008; Gil *et al.*, 2012). Similar examples of the USA's integrated project delivery approach have been shown, through case study research, to enhance innovation and overall project delivery effectiveness to a far greater extent than traditional delivery approaches (Aapaoja *et al.*, 2013; Bygballe *et al.*, 2015; Mollaoglu-Korkmaz *et al.*, 2013).

The study of alliancing forms of collaboration has advanced the understanding of the nature of collaboration and its constituent elements. Walker and Lloyd-Walker (2015), for instance, categorised project delivery forms modelled on extent of ECI, intensity of three-way team "orders of collaboration", extent of incentives for pain/gain sharing and extent of a three-way team "sink-or-swim-together" coalescence of common and joint delivery motivation to visualise the relationships between parties and how that may impact collaboration. Two recent New Zealand PhD theses on the value of intense sophisticated collaboration between POs, designers and contractors shed new light on how alliancing operates in practice (Ibrahim, 2014; Vilasini, 2014). These, together with other alliancing studies from Australia (Cheung *et al.*, 2005; Davis and Love, 2011; Hauck *et al.*, 2004; Walker *et al.*, 2015), provide insights into how alliancing offers a successful project delivery choice involving three-way collaboration.

Morwood *et al.* (2008) extended the understanding of alliances in the construction sector by describing three major alliancing forms. First, project alliances, where an alliance is formed for a single project. Second, programme alliances (service alliances),

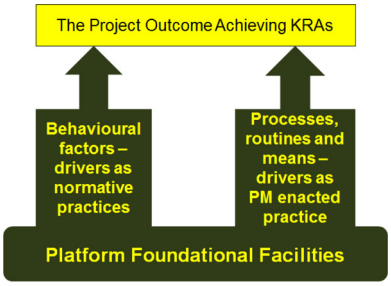
where a consortium of participants are assembled to undertake a programme of projects, often over 5-10 years, generally for developing and maintaining road, rail, water, power, etc. services. Third, a DA that combines the PO and a contractor consortium with design consultant specialists to deliver a design solution for a project. There is scant literature on DAs other than several brief case study vignettes (Alliancing Association of Australasia, 2012).

The EPC project delivery approach is found at the more transactional end of the RBP spectrum. This is a delivery form in which the contractor has the skills, knowledge and experience to assume responsibility for design, procurement of materials and all sub-contracted items as a systems integrator (Lampel, 2001). The EPC form of procurement is one traditionally used for large-scale engineering projects, usually undertaken by engineering companies offering a design and construct service in which a project brief is interpreted, engineering-designed and delivered through the contractor arm of this arrangement that often act as a system integrator as well as management contractor often with significant works undertaken by their contracting arm of the organisation (Yeo and Ning, 2002). This can offer an approach where the client hands over all risk to the EPC entity that manages that risk through its lump sum price that includes risk and time contingency allocations. If the anticipated contingency aspects do not eventuate, or the EPC entity can obviate the anticipated problems through innovation and good luck, then its final profit margin will reflect reward for taking the risk. However, EPC usually involves reactive rather than active collaboration between the PO, design and delivery teams. Based on a database of hundreds of oil and mineral extractive industry projects, Merrow (2011, 2012) argued that the PO should devote more time and energy collaborating with the design and construction teams at the front end of projects.

The RBP taxonomy

The RBP taxonomy developed by Walker and Lloyd-Walker (2015, Appendix 2, pp. 157-223) provides a useful framework for making sense of data about collaboration forms on construction projects. It was developed from an in-depth study of RBP collaboration practices from Australia, the USA, the UK and Europe involving the analysis of 50 recorded interview transcripts from subject matter experts. It is composed of three components comprising 16 elements. This tool's usefulness for this case study is based on a set of measures for each element that can be mapped to provide a visualisation map for any RBP form. It facilitates understanding how collaboration practices may shape a project delivery decision. The map can also be used to prompt discussion about how collaboration practices affect delivery performance of infrastructure projects.

Figure 1 illustrates the main taxonomy components. Each RBP taxonomy element can be assessed affecting collaboration levels varying in intensity between low and high. The taxonomy provides a basis for understanding the extent and nature of collaboration taking place. Walker and Lloyd-Walker (2015, Appendix 2) argue that collaboration requires foundational supportive elements (Elements 1-5). They also maintain that collaboration requires a behavioural factor infrastructure that set collaboration as "the norm" (Elements 6-10). However, while these two collaboration infrastructure components are necessary, they are insufficient. There needs to be a



Note : KRAs = key esult areas
Source: Walker and Lloyd-Walker (2015)

Figure 1.
RBP taxonomy meta level

regulatory or institutional component of routines and means that drive behaviours (Elements 11-16).

The platform component supports the set of behavioural factors that drive normative practices of project participants using shared or inter-operable support mechanisms. These behaviours drive collaborative practice. These behaviours are then institutionalised through processes, routines and means that govern behaviours. The taxonomy offers course-grained descriptor measures that allow each element to be rated on a five-point Likert scale 1 = low to 5 = high. Intensity of collaboration varies and can be measured across each element. In this way, the taxonomy provides a useful framework to visualise the nature of collaboration. It can be used to illuminate and visualise collaborative practices. This tool proved useful in interpreting a set of transcripts about the two phases of the case study project into a visual representation, a map that enhances making sense of the extent of collaboration at each of the two phases and it also frames explanation of influences that guide decision-making.

More general literature on collaboration and its characteristics and implications for project procurement and delivery was considered by Walker and Lloyd-Walker (2015) in the development of the taxonomy. Empirical data framed by perspectives from the literature substantiate each of the 16 taxonomy elements. Readers interested in that literature should refer to that book.

Results and analysis

Some readers may wish to refer directly to Figure 2 and the discussion in the following section. Figure 2 provides a visualisation of research results and analysis of data presented below within the RBP taxonomy to present each element of the taxonomy under the 16 sub-headings. The remainder of this section provides details supporting Figure 2 and explains how the values for each point on the 16 dimensions were obtained.

The taxonomy sub-element and how it is measured is first briefly described. Measurement uses the scales developed by Walker and Lloyd-Walker (2015). The authors' rating for that element is then provided with an indicative supportive quote from the transcripts as evidence for the rating for Phase 1 and then Phase 2 under each element sub-heading. This explains how the two phases can be compared and contrasted for each of the 16 taxonomy elements. Ratings were checked with

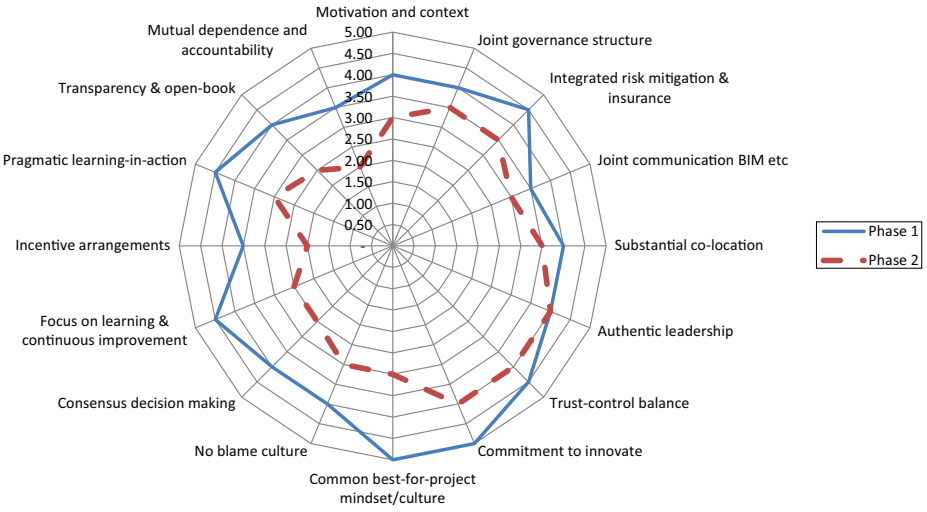


Figure 2.
Case study RBP taxonomy visualisation

interviewees to question and comment on their reasonableness and the following provides the final accepted version.

RBP taxonomy Element 1 – motivation and context of the circumstances
This defines circumstances that influences the potential degree of possible collaboration:

> *Low* represents a *hostile environment* for collaboration. *High* represents project participants accepting the logic of a clear advantage of adopting a focus on a *supportive and collaborative* approach to delivering benefits that align with participants' values.

Phase 1 Element 1 was rated *4.0* because PO-A was effectively jointly dealing with uncertainty using relational collaboration approaches with the client, designer and contractor. PO-B had organisational constraints that forced it into a transactional hands-off more controlling relationship with the design and contractor teams. PO-A's DA approach was more closely adopted in Phase 1:

> Our job was to manage the detailed design of the plant as well as a pilot study because there was some concern that the project may not be viable […] [PO-B's] waste water may not be biologically treatable because there may be some sort of contaminant that would prevent biological treatment […] you could end up with fouling of the advanced treatment water membranes […] (P35).

Phase 2 Element 1 was rated *3.0* because while there was close internal team collaboration between the design and contractor teams this did not extend to the client. There was closer engagement between PO-A and contractor and designer teams than with PO-B:

> […] a complex plant so we wanted to allocate a lot of the design risk across to the deliverer so the contract involved a constructor, in this case [ConC], basically managing the design part and then constructing the project and then being involved in a three month commissioning phase and then handing it over. […] in terms of a very low risk construction process that was very

much successful and it provided the price certainty that [PO B] wanted and the timeframes particularly the government wanted (P29).

RBP taxonomy Element 2 – joint governance structure

This provides a unified way that each project delivery team party legitimises its actions through rules, standards and norms, values and coordination mechanisms such as organisational routines, and how committees, liaison and hierarchy represent a unified or complimentary way of interacting:

> *Low* represents a *laisez faire* approach where each participating project team has established its own individual stand-alone project governance standards with little coherence in alignment of the project delivery organisational processes and structure with few explicit expectations about what success looks like and how to define and measure it. *High* represents an effectively structured, uniform, integrated and consistent set of performance standards that apply across and within the project delivery teams. All participant organisations share a common understanding of how to organise for success and what constitutes valuable project output and outcome success.

Phase 1 Element 2 was rated *4.0* because high-level representative members formed an executive group that worked with the team developing the design. There was a lot of experimentation with the technical details through the pilot studies and so this required high levels of collaboration, open-book monitoring of direct costs and transparency in accountability:

> We had a steering committee or governance group between myself and a couple [of people] from [PO-A], a couple from [ConC] and a couple from [PO-B]. […] we had a governance steering committee between ourselves and [PO-B] to make sure that we as the clients were happy with the project and also to keep that funding partnership relationship good (P29).

Phase 2 Element 2 was rated *3.5* because the governance arrangement was very much one of the contractor ensuring that the fixed price and fixed time was met. PO-A was more involved with clarification of ambiguous or uncertain details and PO-B had greater direct interaction with the contractor on matters relating to on-site safety, access etc.

> […] So [ConC] was the principal contractor. […] but we were engaged under an EPC contract which was [PO-Bs] preference. […] So it was a hard dollar contract. A concept had been developed by [SDes-1]. Our job was to manage the detailed design of the plant as well as a pilot study (P35).

RBP taxonomy Element 3 – integrated risk mitigation strategy

This relates to the way strategy is organised for all parties to be part of the client's risk management system. This impacts explicit understanding of how to collaboratively manage risk and uncertainty and gain advantage from a project-wide insurance policy:

> *Low* represents an immature and confused individual firm-specific risk management approach and poorly defined systemic approaches to deal with uncertainty and ambiguity. *High* represents consistent and integrated risk assessment processes being identified, assessed and mitigated against a project-wide systems-wide impact for the project or network.

Phase 1 Element 3 was rated *4.5* because the risk mitigation strategy followed an alliancing approach with high-level and intensive discussion about how the design evolved, what contingency should be applied and how that was reduced during the

design process through clarification of uncertainty and elimination of ambiguity through gaining shared understanding of issues and implications from the PO, designer and contractor perspective:

> […] we did a value engineering workshop where we're looking for innovation as well as adjustments to specification to bring the price down and that process went for probably nearly three months to revisit the design and reduce the cost (P35).

Phase 2 Element 3 was rated *3.5* because risk management required the contractor to ensure that costs were realistic, scope was not allowed to creep and that all safety and environment potential risks had been considered and dealt with. There was sufficient good will in the arrangements to allow mutual adjustment in line with realistic expectations:

> [PO-B] weren't hands-off from a financial sense but from a technical sense they were very hands-off, as far as they're concerned […] they didn't really care what was built as long as it didn't cost too much and as long as it solved the problem (P49).

RBP taxonomy Element 4 – joint communication strategy

Strategy included system integrated processes and the extent of common information and communications technology (ICT) groupware use including building information modelling (BIM):

> *Low* represents poor quality staff interaction, use of firm-specific rather than project-wide processes and ICT systems and weak cross team mechanisms for gaining mutual understanding. *High* represents well integrated processes that are well understood by all participants and advanced communication technologies being used that seamlessly connect all project parties.

Phase 1 Element 4 was rated *3.5* because systems integration was reasonably well aligned to allow transfer of information and interoperability; however, BIM was considered unnecessary. However, there were no consistent and solidly integrated common ICT BIM-type platforms to aid coordination. Team integration relied on personal relationships and standards of professionalism:

> [other participants and subcontractors etc.] link into our portal to get access to a whole heap of system based stuff. So training information, toolboxes, templates, checklists, procedures and all that sort of stuff. But not so much access to programming or estimates (P31).

Phase 2 Element 4 was rated *3.0* because the parties tended to follow ConC's ICT and management systems. These were quite sophisticated, but did not extend to BIM and other advanced manufacturing technology management approaches. ConC took the systems integration lead with the designers and directly helped them to manage the design documentation phase and collaborated with them on clarification of details and communication design interoperability issues:

> […] we ended up putting people in their office to get them to work more effectively. […] you need a team that understands the project and understands what it can look like. […] The second point, so they have to understand the process and the technology (P35).

RBP taxonomy Element 5 – substantial co-location

This measures the extent to which project teams are within easy physical reach of each other, facilitating *ad hoc* encounters to improve building relationships and facilitating common understanding:

> *Low* represents firm-specific policy determining that disparate teams are physically located in dispersed locations. A large visibility gap exists between project leaders and those at the "coal face". *High* represents project-wide policy that attempts to maximise participant co-location on-site where feasible including the POR with high interaction between project leadership groups and the project management and physical delivery team members.

Phase 1 Element 5 was rated at 4.0 because of close inter-team physical proximity with a single location as the focal point of design work. There was no one-team badging or separate project office. Executives from the participant groups did not meet onsite or at the project office location for direct project oversight and governance reasons:

> […] for the majority of the design phase the two design teams [SDes-1 and SDes-2] were together in [SDes-2's] office and the main project manager and the engineering manager from [ConC] were also in the same office so there was no difficulty in achieving adequate communications between all the parties (P49).

Phase 2 Element 5 was rated *3.5* because of close inter-team physical proximity. The team worked together substantially on site in a single location as the focal point of construction work. This was significantly conducted in a business as usual. Design team members were employed on the project when needed rather than being dedicated permanently onsite:

> […] basically the design consultants didn't really have a lot to do during the construction phase that was pretty much just [ConC], we'd occasionally go down there but we weren't really required that often. […] it was an on-call as required assistance rather than being part of a construction team […] the plant was broken up into the front end which was the biological treatment section and then the advanced water treatment which was the membrane section and [SDes-1] looked after the front end and [SDes-2] looked after the membrane end (P49).

RBP taxonomy Element 6 – authentic leadership

This measures the possession of ethical principled values and consistency of action with espoused rhetoric. This applies across the project delivery team at every level not only for the project lead person(s) but also the supporting design and supply chain team leaders. Typically, authentic leadership is comprises *reflectiveness, pragmatism, appreciativeness, resilience, wisdom, spirit* and *authenticity*:

> *Low* represents espoused principled values are not demonstrated in action manifested through a gap between the rhetoric and reality of leading teams. *High* represents demonstrated consistency in espoused and enacted values that are genuinely principled.

Phase 1 Element 6 was rated *4.0* because ECI on this kind of project requires high levels of emotional intelligence, being able to understand the other party's perspective and acting with consistency to explicit core espoused values. PO-A was gaining experience in alliancing style authentic leadership while PO-B was unfamiliar with the concept. SDes-1 and ConC both had experience of alliancing though not all those involved in the project had alliancing experience. All team members engaged in high levels of

collaboration and developed respect for each other's expertise. Projects objectives were made clear and consistent:

> […] people and their skills need to not be hard headed in their approach but be very much focussed on the relationship […] It's about having a framework to work within around behaviours that are acceptable […] (P35).

Phase 2 Element 6 was rated *4.0* because PO-A took a "hands-off" approach, with ConC taking most of the integration leadership role due to sound experience of both design management and physical project delivery. There was more emphasis on pragmatism, many of the technical issues had been addressed in Phase 1 and PO-B stressed accountability and value for money more highly than the quality of the relationship. EPC requires a command and control leadership style and this was what teams expected and was how the project was managed. The Phase 1 legacy was that all expected a collaborative approach and all understood each other's motivation and business reward requirements:

> […] Once the construction happened it went really smoothly for a project of a lot of complexity, a lot of interfaces. They had a workforce of at some stages 150 + people out there and a fairly volatile industrial relations environment (P29).

RBP taxonomy Element 7 – trust control balance

This relates to representing and protecting the interests of project leaders with that of other genuinely relevant stakeholders while relying on the integrity, benevolence and ability of all project team parties to "do the right thing":

> *Low* represents extreme naivety by participants about trusting others implicitly or alternatively by exhibiting high levels of suspicion and/or unreasonable demands for formal and informal control and monitoring that implies a cynical attitude towards trust of others. *High* represents innate sensibility to juggle transparency and accountability demands with the need for trust with necessary due diligence. It also demonstrates a professional understanding of the nature of project participant accountability constraints and opportunities for resolving and possible helping resolve institutional paradoxes so that accountability is consistent with accepted responsibility.

Phase 1 Element 7 was rated *4.5* because PO-A was comfortable with a DA form, yet PO-B had a corporate policy that demanded an EPC approach. The DA-type approach being adopted required negotiated hourly rates against firm and reasonable target estimated hours. There was a strong culture of "trust-but-verify", ensuring that no abuse of trust was occurring and to assure transparency and accountability:

> […] it was to some extent open book in that they expected fairly detailed evidence of hours used, costs used versus progress on deliverables of drawings […] (P49).

Phase 2 Element 7 was rated *4.0* because there was a fixed rate cost for all direct management costs for ConC's 100 per cent at-risk cost and time tender in addition to a commissioning and testing period to ensure the plant's operational performance after hand over of the plant to PO-A. ConC hired the designers SDes-1 and SDes-2 as part of their bid price:

> […] the client […] expected that what was written in the contract that would be how the project would be delivered and that just wasn't the case. So there were many times where issues

> revealed themselves and we had to work very closely with [PO-A] […] our price that they accepted for the construction phase that was all open book and fully scrutinised by the independent estimator (P35).

RBP taxonomy Element 8 – commitment to be innovative

This measures the degree of being within a structured mechanism that enables and empowers people to be innovative, facilitating a project team participant's capacity for learning, reflection, creativity being ambidextrous and the organisation's core values of supporting and rewarding questioning the status quo:

> *Low* represents inadequate or incomplete linkage of motivation, ability and facilitation for innovation within the context of the procurement form. *High* represents vision, objectives and desire to be innovative with well-considered instruments to measure and demonstrate innovation, motivation through rewards and incentives and demonstrated high levels of existing absorptive capacity for innovation.

Phase 1 Element 8 was rated *5.0* because this project demonstrated the highest level of innovation. Facilitating innovation involves collaboration across disciplines, exposing ideas to scrutiny and being challenged and being built upon. A sustained and rigorous pilot study was undertaken by developing and testing the design over several cycles until finding the most feasible solution:

> A concept had been developed by [SDes-1] Design Consultants. Our [ConC] job was to manage the detailed design of the plant as well as a pilot study […] we did a value engineering workshop where we're looking for innovation as well as adjustments to specification to […] make the plant much easier to operate and therefore less maintenance and more process up-time […] (P35).

Phase 2 Element 8 was rated *4.0* because most of the innovation had been already built into the design and so there was little room for further innovation. However, the EPC approach encourages further innovation through the 100 per cent pain-gain incentive. The PO and design team gains no advantages from innovation:

> I can think of many, many times where I would call in our safety people, environment people and other staff and we would sit around the table with [PO-A] and walk them through this process so that they understood why we were doing things the way we were doing them which was perhaps not as what they've described in the contract but we'd still give them the outcome they were looking for (P35).

RBP taxonomy Element 9 – common best-for-project mindset and culture

This measures the focus on value generated in delivering the project compared with objectives of delivering what was explicitly requested or demanded being directed at a positive and successful project outcome rather than individual teams being winners or losers:

> *Low* represents higher level of priority for individual benefit realisation at the potential expense of other project team members and the project owner. *High* represents a genuine attitude that "we all sink-or-swim together" and a focus on maximising value to the project or network. Contractual arrangements will reinforce pooled gain or pain based on performance measured by KRAs and KPIs.

Phase 1 Element 9 was rated *5.0* because there was a very high best-for-project focus. The viability of the project depended upon developing a feasible and sustainable technical and commercial outcome. Environmental considerations were also a driver for project success:

> […] there were a few iterations in the design in order to trim the price so that it would suit the overall budget and so while it wasn't alliancing in its purest sense it was certainly a collaborative effort between [PO-A], [PO-B] and the design team led by [ConC] (P49).

Phase 2 Element 9 was rated *3.0* because the EPC approach places focus on constrains of cost and time-contracted conditions and so this became a commercial-oriented project for the contractor. Phase 2 also required operational testing for 3 months after completion before the plant was accepted as fully handed over and this required the plant to work as promised influencing a best-for-project final outcome:

> I can think of many examples where the client, because of what was written in the contract, expected that because X was written in the contract X would be how the project would be delivered and that just wasn't the case. […] there were many times where those types of issues revealed themselves and we had to work very closely with [PO-A] to adjust their expectation that they had (P35).

RBP taxonomy Element 10 – no-blame culture

This measures the extent of teams welcoming being accountable for problems as they arise rather than shirking or shifting responsibility to others who may be vulnerable to being blamed for potential failure. It is also about discussing problems in an unprejudiced way and being opening to see issues from multiple perspectives:

> *Low* represents a project participant's high propensity to shift blame from themselves to others. These problems may be attributable to them for unforeseen, unanticipated or unwanted events that impact adversely upon project delivery. A low no-blame culture is also palpable by a tendency to avoid acknowledging potential problem situations in the hope that blame can be attributed to others. *High* represents a culture of open discussion of problems, unforeseen, unanticipated or unwanted events that may impact adversely upon project delivery. It is may also be manifested by the PO taking ownership of risk elements that other participants are unable to bear rather than force them to accept accountability for such risks.

Phase 1 Element 10 was rated *4.0* because the experimental piloting of a design for a plant was undertaken in a highly no-blame culture. The other major feature was time and cost budgeting and developing the design within firm parameters. A key outcome of the project was strategic, ensuring more effective water supply. There were some tensions surrounding the PM aspects where greater control was expected. The parties respected each other's expertise to create a no-blame workplace culture. This was despite the task of refining a technically complex project with high expectations of an effective design outcome demanding high expectations:

> […] haven't had any instances of blame. It's been a very collaborative partnership I guess in that our wins are our wins and our losses are our lessons and it's never, you have something that's hasn't come quite right and it's all been about we sit down and say well, okay, where do we go to from here and how do we fix it, and everyone get agreement and we move forward. So that's been one of the probably more enjoyable parts of the alliance (P36).

Phase 2 Element 10 was rated *3.0* because the ConC accepted total time and cost budget demands set by the contract as well as to deliver an efficient and effective water treatment plant. During this phase, the relationships between ConC and the designers, the sub-contractors whose work packages they supervised and the POs became transactional, although Phase 1 instilled an alliance form project culture. An EPC contract does not require a no-blame contract clause. ConC seems to have managed relationships smoothly by taking a more supportive approach, without resorting to "finger-pointing":

> […] Because of their [PO-A and PO-B] inexperience in delivering a project of this kind we've had to work very hard on the relationship with the client in bringing them along the journey of learning what it is they need to do as well as keeping a focus on our subcontracting and making sure they deliver what is expected and what is necessary. It became evident on a number of occasions that they [SDes1- and SDes-2] were unable to manage themselves effectively and so we put people [ConC] in their office to help them manage themselves (P35).

RBP taxonomy Element 11 – consensus decision-making

This measure the extent to which there is total agreement on a decision made at the *project strategic and project operational executive level*. This requires extensive time for discussion, exploration and testing mental models and this may be contrasted with the interest of speedy decisions and action to counter crises:

> *Low* represents a highly hierarchical project team leaders' leadership style where power and influence determines how decisions are made and where the expected response is that decisions are implemented without question or complaint with a tendency for a domination of top-down directives being issued as edicts. *High* represents a highly egalitarian and collaborative project team leadership style. Issues and problems requiring a decision develop out of inclusive knowledge sharing and discussion of perspectives, expected intended and unintended consequences and implications of decisions. High levels of feedback, good or bad, are sought.

Phase 1 Element 11 was rated *4.0* because close collaboration required alignment of objectives as the trial-and-error pilot plant process forced teams and the client to consider what worked and what needed further attention. Each party contributed their skill and expertise as equals in a single team in a professional manner:

> […] We have KPIs on, dates on our projects and we'll be looking at design delivery and saying well, we've got to get these designs done by a certain date because that's what our KPIs are linked to. So if you can get the team members thinking like that and thinking about those KPIs then it's not just the management team driving them, you've really got to try and get the wide project team to live and breathe those KPIs and bring it into the work that they're doing on a daily basis (P36).

Phase 2 Element 11 was rated *2.5* because there was a greater focus on command and control to ensure that the design delivered expected results and remain on cost and time. ConC was managing contractor of all the sub-contract packages and exerted hierarchical power while working with sub-contractors and the designers in a relational manner. The client contractor relationship was subject to some mutual adjustment of expectations and action:

> […] [PO-A] were expecting […] that ten days before any work started a safe work method statement would be given to them for review and that's not how [ConC's] systems work and not

how the industry works but because that was the way it was defined in the contract we were somehow supposed to revolutionise the way our subcontractors work in accordance with the contract (P35).

RBP taxonomy Element 12 – focus on learning and continuous improvement

This measures the extent of providing a compelling projects-as-learning value proposition and the practice of transforming learning opportunities into continuous improvement:

> *Low* representing actors within collaborative arrangements and a network delivering a project being blind to and failing to grasp the potential competitive advantage of applying presented learning opportunities. *High* representing actors within collaborative arrangements and a network delivering a project being alert and aware of opportunities for improvement and being successful in grasping competitive advantage through effectively harvesting lessons learned.

Phase 1 Element 12 was rated *4.5* because the pilot plant design was essentially a learning and continuously improvement experiment involving a collaboration of design expertise in technology, operational know-how of the client PO-A and contractor with practical construction knowledge:

> […] we had a basic design that we expected would work but that was the real purpose of the six month pilot trial was to confirm that a biological treatment system would treat the [PO-2] waste water or the combination of the [PO-2] waste water and the domestic sewerage to a level that you could still acceptably filter the secondary treated effluent through the UF and RO membranes without getting excessive fouling of those membranes (P49).

Phase 2 Element 12 was rated *2.5* because the focus was on ensuring that the design delivered its promise where innovation, improvement and efficiencies could be effected to contribute to the contractor's profit by cost and time efficiencies. The continuous improvement was somewhat limited because this was a once-off project and the advanced stage of the design prior to Phase 2 beginning:

> […] the contract and its framework was that the construction wasn't to start until the project was well-defined and [ConC] knew that there would be very little opportunity for variation or increased scope (P35).

RBP taxonomy Element 13 – incentive arrangements

This assesses the structure of a pain–gain sharing agreement, how the process was instigated and how it operated to create an incentive to excel:

> *Low* represents little emphasis placed upon encouraging parties to place potential profit and gain-pain in a risk-reward arrangement subject to a whole-of-project outcome performance. KRAs and KPIs are absent or rudimentary. *High* places much emphasis upon encouraging parties to agree to place potential profit and pain-gain in a risk-reward arrangement that is subject to a whole-of-project outcome performance. KRAs and KPIs are well developed, provide stretch and challenge and are sophisticated in their understanding of the project context.

Phase 1 Element 13 was rated *3.5* because parties first estimated a time-based target outturn cost and priced it using negotiated hourly rates together with direct costs. Pain share and gain share potential is less varied that would be the case for a full alliance that stretches across both the design and delivery phases. Hourly rates compensate for

specialised knowledge. This project followed a DA cultural style, but without pain–gain sharing or direct behavioural contractual legs of the agreement between the design and contractor parties. It followed the more voluntary partnering-like collaborative form of relationship. ConC and PO-A also had previously collaborated on a programme alliance:

> […] pretty much a lump sum in that we [SDes-1] had a deliverables list and we were paid on percentage of deliverables complete. […] there wasn't any pain share gain shares […] so if we managed to do our job for less than expected then we'd still get paid the same amount but our cost would be a bit less and vice versa (P49).

Phase 2 Element 13 was rated *2.0* because pain sharing and gain sharing is 100 per cent for the contractor who has to include contingency to cover unknowns and ambiguities and follow-on design and re-design work that emerges as necessary. Phase 1 work that also involved all parties helped to minimise contingency because at the time the EPC bids were solicited and the bid process managed ConC together with SDes-1, SDes-2 and PO-1 and PO-2 had thoroughly explored potential uncertainties through the pilot study work and were able to define and effectively price these items that would normally become contingency estimates. This reduced scope for further innovation by ConC and likely time overruns from unforeseen events related to design uncertainties or ambiguities:

> [ConC] was the principal contractor. It was an ECI process, early contractor involvement, but we were engaged under an EPC contract which was [PO-B's] preference (P34).

RBP taxonomy Element 14 – pragmatic learning in action

This measures value through teams collaborating with the strategic aim to gain competitive advantage through collective opportunities to learn and adapt. Team leaders and members see the project as a learning experience with acceptance that both experimental success and failure requires discussion and analysis. Often, unexpected opportunities arise out of failed experiments through assumptions being re-framed that lead to promising benefits in other contexts:

> *Low* represents actors within a network delivering a project to fail to translate learning opportunities into actual benefits and competitive action. Failed experiments are punished. *High* represents actors within a network delivering a project capitalising on learning opportunities to achieve competitive action. This can be also assessed by the weight that these actors place on the value of experimentation as a way to see issues and solutions in a new light. Failed experiments are valued for their intellectual stimulation in discovering for example, a better understanding of cause-effect loops.

Phase 1 Element 14 was rated *4.5* because it was undertaken within a very high context of experimentation and learning in action with all parties eager to learn from each other. Co-location and regular interaction allowed a great deal of action learning:

> […] The [PO-A] people were used to dealing with treatment of regular sewage but a little bit different and we brought one person over from the States who'd sort of done this previously and got him to cast his eye over it. […] for the majority of the design phase the two design teams were together in [SDes-2] office and there were two, the main project manager and the engineering manager from [ConC] were also in the same office (P49).

Phase 2 Element 14 was rated *3.0* because the focus was on getting on with the job and making the similar kinds of innovations and continuous improvement that occurs on

any business as usual project. The approach was to capitalise on knowledge gained from Phase 1 to deliver the organisational learning framework. An integrated team approach meant that ConC acted as coach and mentor to PO-A, the design team and vice versa:

> […] I can think of many examples where the client because of what was written in the contract expected that because that was written in the contract that would be how the project would be delivered and that just wasn't the case. […] there were many times where those types of issues revealed themselves and we had to work very closely with [PO-A] to adjust their expectation that they had. Because their project management staff were so inexperienced we had to really educate them as to how the industry works (P35).

RBP taxonomy Element 15 – transparency and open book processes, routines and practices

This measures the extent to which project participants agree to be audited and be fully open to scrutiny. Actors within the project network would have confidence that they can trust those inspecting their books to not take advantage of that access and information. People doing the audits, due diligence and inspections must be capable and effective enough to understand the implication of what they inspect. Total transparency and accountability is necessary where the project is undertaken on a cost-plus basis where the PO is funding all direct, administrative and management costs. The extent of transparency and accountability is a trade-off between the PO playing a "hands-on" or "hands-off" role:

> *Low* represents intensely protects the security of organisations and individuals to gain access to information about cost structures or the basis of project plans. It seeks to hide both good and bad news, however this often results in mistrust that undermines collaboration and opportunities for constructive change. *High* represents presenting opportunities for generating trust by clients and other parties that may access that information. It is a confronting notion that many organisations cannot face. It requires the project owner's authorised probity auditors to have free access to their financial books. Thus, confidence in ethical and legal business conduct is necessary to accept this challenge.

Phase 1 Element 15 was rated *4.0* because negotiated hourly rates and target time and quantity of hours to complete the design were validated by the POs. They both were insistent on probity but also accustomed with dealing with teams on this kind of arrangement. In particular, PO-A had sound knowledge of what was realistic and reasonable to be charged and had past experience to draw upon of alliancing. PO-B had access to global data on market rates for consultants and expected productivity. The original PO's budget expectations proved unrealistic and it was through an open and transparent process. The original design was scrutinised openly with all DA partners to better understand constraints and opportunities. This resulted in substantial cost saving through design of a more feasible solution:

> I think it was to some extent open book in that they expected fairly detailed evidence of hours used, costs used versus progress on deliverables of drawings and all that sort of stuff (P49).

Phase 2 Element 15 was rated *2.5* because the contract had locked the POs out of expecting to achieve any access to the consultant's or contractor's accounting information because it was a "hands-off" EPC arrangement. Phase 1 allowed transparency of knowing what the scope was and changes were minimised, so this

affected the need for detailed access to unit rates. The process was undertaken to ensure propriety and due diligence. Transparency and accountability was low in Phase 2 because of the "hands-off" arrangement inherent in an EPC:

> It was a select tender if you like, competitive-based and [PO-A] was involved in all of those processes. So they were fully informed and advised as to who we went to tender, they saw the tender documents go out, the prices come back and then after the submission of our lump sum price they had full visibility on how the price was developed (P35).

RBP taxonomy Element 16 – mutual dependence and accountability

This measures the extent to which collaboration in projects requires participants to not only recognise their inter-dependency but to also honestly respond to a sink-or-swim-together workplace culture. Governance systems support and enhance or alternatively they may inhibit individual team responsibility and accountability approaches to cross-team collaboration:

> *Low* represents an inability or lack of desire to acknowledge the potential value of team inter-dependence and accountability. Participants follow individualistic paths, possibly at the expense of others, and/or do not support a sink-or-swim-together workplace culture or they actively undermine that culture. *High* represents an ability and keen desire to acknowledge team inter-dependence and accountability in ways that builds inter-team trust and commitment through actively enhancing a sink-or-swim together workplace culture and to actively counter any actions that may inhibit this culture.

Phase 1 Element 16 was rated *3.5* because high levels of collaboration and integration though the level of branding as a "one team" was not evident and appeared not to be an objective. There was, however, much interdependency because the design involved piloting and experimentation and there was co-location, yet little evidence of a sink-or-swim together mind-set:

> […] I think we were prompting the client. They were prompting us when it was needed. I think there was enough support for each other to be able to get through what needed to be done. […] […] We were able to deliver the design but it was a lot more painful than I think it needed to be but we got there in the end (P35).

Phase 2 Element 16 was rated *2.0* because the design was so well-advanced and unknowns and ambiguity had been clarified in Phase 1 and this resulted in little need for high levels of mutual dependence. Each party either made or lost money on the project individually:

> During the construction phase basically the design consultants didn't really have a lot to do during the construction phase: that was pretty much just [ConC], we'd occasionally go down there but we weren't really required that often (P49).

Discussion

The RBP taxonomy allowed the interviews to be coded to each of the 16 elements and for the researchers to make a rating assessment that could be checked and commented upon by the interviewees. This provided a map of the level of collaboration between the Phase 1 DA and the Phase 2 EPC approach to the project's design and delivery stages.

Figure 2 illustrates the ratings provided above. It clearly shows the differences in relationships between the teams. This is interesting from several perspectives.

The quality of relationships between the parties in Phase 2 is clearly less integrated and characterised as a one-team approach to delivering the project than in Phase 1. However, as the senior executive in PO-A stated, it was a highly successful project. The original final outturn cost was substantially more than the original budget; however, the interaction that took place in Phase 1 considered the original budget to be unrealistic, particularly as this was applying known technologies and tuning it to operate in a completely new context. Therefore, known historical costs used as a guide by PO-A and PO-B to prepare the original budget were inadequate. Developing the design in Phase 1 and the project's revised budget resulted in far greater understanding of the project's requirements. This resulted in all parties understanding the risks involved to arrive at a more informed and accurate estimate of cost and time and extraordinarily low contract variations during Phase 2.

The motivation to collaborate in a DA-style manner was high in Phase 1 and medium in Phase 2, mainly because of the known unknown aspects of the project. It was known that mixing town waste water with the industrial waste stream would have unknown consequences. Therefore, there was a need for experimentation and fine-tuning the filtration and treatment technology of the pilot plant and this was best served by merging the knowledge, skills and experience of the design team and contractor for project delivery and for PO-A. PO-A had the effluent treatment expertise to understand long-term operational implications of various design options. The DA-style project design stage facilitated developing a successful design that optimised the design solution.

All participates stated that PO-B's corporate policy forced the transformation of the Phase 1 DA to an EPC Phase 2 rather than continuing with an alliance-style form of project delivery. Phase 2 required market testing for a lump sum solution and the successful tender drawn from a pool of contractors with expertise in this technology resulted in ConC winning that bid. One could expect this as ConC must have accumulated a wealth of tacit as well as explicit knowledge about the design and would have viewed risks in a more informed way than other potential bidders. The PO-A and PO-B depth of involvement in Phase 1 would have facilitated them being far more informed to know how to better assess tenders and better assess risks than would be the case using a business-as-usual approach.

Some of the similarities in scores illustrated in Figure 2 include leadership style, which was rated high for authenticity in both Phases 1 and 2. This is not surprising as the same leadership team was involved, but it also suggests that contract form does not necessarily lead to authentic leadership. Other linked elements to authentic leadership, the trust balance, communication strategy and joint governance structure were also close in their ratings for Phases 1 and 2.

The difference in the incentive arrangements are a natural consequence of moving from a DA-style to EPC contract arrangements. Mutual dependence would naturally be quite different as the "hands-on" Phase 1 moved to a PO "hands-off" role. Similarly, the transparency and open-book approach in Phase 2 would be drastically reduced because the PO is in a "hands-off" contractual mode. The best-for-project motivation would also change, as in Phase 2, ConC would aim to optimise its commercial return while balancing a sound professional relationship with the design and PO team members. No-blame culture as well as decision-making style moving from consensus to ConC-driven was also a natural consequence of the EPC delivery arrangements.

The focus on learning and the pragmatic learning in action also shows large rating differences. This illustrates lost opportunities for all parties to gain knowledge and shared experience in Phase 2 as well as knowledge transfer from the project team back into their organisations.

Respondents were not asked to provide any value judgement on the emphasis shift in collaboration from Phase 1 to Phase 2. However, reflections were offered during the interviews as follows:

- Phase 1 had resulted in many known-unknowns being identified and dealt with. This allowed the contractor to effectively plan project delivery. There were no known-unknowns that threw the ConC team into any substantial quandaries that required close PO and design team collaborative interaction.
- Phase 1 took a DA-style, but not a fully fledged DA form. There were no pain share and gain share measured put in place and the project was not badged as an alliance. This reduced potential collaboration benefits, whilst Phase 1 was characterised by high levels of unity of purpose and collaborative relationships that facilitated significant project complexity understanding.
- The RBP taxonomy a useful framework for analysis of the case study. It also provided a useful visualisation tool. Visualising relationship attributes and dimensions is potentially useful for making understanding the impact of collaboration on innovation capability. It may be used on future projects as a modelling tool when POs are considering hybrid procurement forms and assessing likely team behavioural consequences.

Conclusion

This case study uses the RBP taxonomy as a framework for analysing relationship aspects experienced in the delivery of complex project. It is useful and makes a contribution to knowledge in the way that the taxonomy provides tool to understand how two very different phases of the project were managed. It allowed comparison of a DA-style with an EPC approach for two phases of the same project and we were able to highlight some aspects that illustrated how innovation was facilitated.

The case study analysis provided an opportunity to offer a new contribution to the literature on project delivery approaches. While the taxonomy presented by Walker and Lloyd-Walker (2015) provided a useful tool and also explains how it may be used. The pilot case study of its use and the visualisation example (Figure 2) helps to bridge a gap between theory and practice by illustrating the taxonomy's practical application.

Figure 2 provides a useful visualisation tool and quotes across Phase 1 and Phase 2 illustrates *how* the project was managed and what influenced the DA decision.

Two main reasons become clear to answer *RQ1* that were answered through the discussion of the theoretical framework and the case study details and context discussion:

- High-level uncertainty and complexity drove the DA model choice.
- PO-B's corporate policy directions required an EPC form in Phase 2.

RQ2 is answered from the above analysis, more specifically, in the Discussion section. The outcome is suggested in Figure 2 and illustrates the RBP taxonomy ratings as far

less collaborative in Phase 2; however, the POs felt that most of the uncertainty had been removed to render the project more complicated rather than being complex.

The case study's limitations are acknowledged. Only five participants were interviewed. However, these were key staff with intimate expert knowledge as experts. It would have been preferable to interview more participants; however, this study aimed to pilot test the RBP taxonomy and to gain greater insights into ECI practices.

The conclusions that may be drawn from this study is that it is possible to start a project based on a DA-style approach and if the circumstances warrant to change to whatever project procurement fits the risk acceptance profile of POs and the team delivering the project. The project was considered a success and even won industry awards and so the chosen approach was shown to be vindicated and successful.

Another important conclusion that can be drawn is that innovation was far more evident during the DA Phase 1 of the project than the EPC Phase 2.

Finally, in terms of the use of the taxonomy for analysis, as illustrated in Figure 2, the evidence suggests that it would serve as an effective tool to advance in project management practice. Figure 2 for this case study clearly illustrated gaps between values of the two procurement approaches. These identified gaps could be used as a trigger for debate and reflection by those initiating project procurement decisions so that a more informed debate can take place about how to frame and structure the contractual form.

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