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## **Incentive Mechanisms in Infrastructure Projects: A Case-based Comparison Between Australia and the Netherlands**

**Leentje Volker and Tim Rose**

### **Proceedings Editors**

**Amy Javernick-Will, University of Colorado and Ashwin Mahalingam, IIT-Madras**



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## **INCENTIVE MECHANISMS IN INFRASTRUCTURE PROJECTS: A CASE-BASED COMPARISON BETWEEN AUSTRALIA AND THE NETHERLANDS**

Leentje Volker<sup>1</sup>, and Timothy M. Rose<sup>2</sup>

### **ABSTRACT**

Despite a general belief that incentive mechanisms can improve value for money during procurement and performance during project execution, empirical research on the actual effects is nascent. This research focuses on the design and implementation of incentive mechanisms in four different infrastructure projects: two road reconstructions in the Netherlands and two building constructions in Australia. Based on an analytical framework of key motivation drivers, a cross cases analysis is conducted in view of performance on the contract assumptions, selection phase, execution phase and project contract performance.

It was identified that despite significant differences in the project characteristics, results indicate that they experience similar contextual drivers on the incentive effectiveness. High value was placed on risk allocation and relationship building in the selection and construction phase. The differences can be explained from both contextual and project related characteristics. Although there are limitations with this research in drawing generalizations across two sets of case projects, the results provide a strong base to explore the nature of incentive systems across different geographical and contextual boundaries in future research.

**KEYWORDS:** incentives, collaboration, infrastructure projects, Australia, the Netherlands, project performance

### **INTRODUCTION**

Despite a general belief that incentive mechanisms can improve value for money during procurement and performance during project execution, empirical research supporting this is limited (Verma, Mitnick and Marcus 1999, Rose and Manley 2011). Strikingly, Bresnen and Marshall (2000) state that “the prospect that it may be possible to ‘engineer’ collaboration and trust through ‘formal’ mechanisms, such as team-building and incentives systems, has led to a profusion of reports and manuals aimed at providing practitioners extensive guidelines for ‘best practice’ in partnering or alliancing”.

The ability of an incentive mechanism to encourage collaboration and the formation of trust is driven by the intention of the formal reward to promote effort towards high level performance goals. This can potentially be achieved by having reward recipients share in the client’s success from the project in a wide range of performance areas such as cost containment, schedule performance and quality of workmanship. However, the effectiveness of an incentive mechanism to promote effort towards client goals is highly sensitive to the context in which it is applied (Bresnen and Marshall 2000). Thus, if an incentive mechanism is not carefully designed

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<sup>1</sup> Post-doctoral researcher, Delft University of Technology, the Netherlands, L.Volker@tudelft.nl.

<sup>2</sup> Research Fellow, Queensland University of Technology, Project Management Academy, Australia, tm.rose@qut.edu.au.

to suit its context, it may induce undesired behavior, inhibiting the formation of the trust and cooperation.

A key challenge faced by incentive designers is to align formal incentive mechanisms with informal governance arrangements in a complimentary way. This challenge is compounded by the complex nature of the construction supply chain, where production is fragmented (Mitropoulos and Tatum 2000) and typically characterized by disjointed relationships between contracting parties (Rahman and Kumaraswamy 2004). The unique multi-firm production model used on construction projects can result in difficulty in assessing performance where project teams are highly interdependent i.e. individual output is difficult to distinguish from group output. Under these conditions, motivation toward incentive goals need to be encouraged at both personal and organizational levels, but also across a highly interdependent, but contractually fragmented project team (Rose and Manley 2011).

Furthermore, incentive systems have both a social and a contractual component that influences their effectiveness. In terms of the project delivery process, the procurement phase mainly focuses on the legal establishment of a collaborative agreement while the execution phase has an evaluative character about the results of the collaboration. By negotiation in the procurement phase, the client intends to steer the direction of the results. However, these results need to be acceptable from both sides to effectively encourage positive motivation towards client goals.

In light of the need to consider contextual drivers, common lessons may be derived from comparing the design and implementation of incentive mechanisms across different delivery strategies and environmental contexts. Comparative analysis provides guidance for improving the effectiveness of incentive mechanisms to promote improved project performance. Therefore, the research presented in this paper addresses the actual design and implementation of incentive mechanisms in infrastructure projects and compares these characteristics to derive similarities and differences across the Australian and Dutch contexts.

Firstly, the context of public construction projects and the characteristics of incentive mechanisms are explained. Secondly, a comparative study of four cases project studies is reported. The research identifies several differences between the Australian and the Dutch context but also shows similarities in the success or failure of incentives, contributing to the knowledge of how incentives should be designed and implemented to encourage improved project performance. To build on these exploratory findings, future research is recommended.

## **THEORETICAL BACKGROUND**

### **The nature of incentive mechanisms**

At a fundamental level, construction incentives aim to increase the motivation and commitment of project stakeholder and the ability of an incentive to induce motivation are founded on principles of work motivation theories. Work motivation can be defined as a set of external and internal energetic forces that initiate work-related behavior and determine its form, intensity, direction and duration. Reward systems such incentives affect motivation, which in turn determines effort and ultimately impacts on performance (Van Herpen, Van Praag and Cools 2002).

Although there are a wide range of motivation theories, three key theoretical constructs are argued to usefully inform the nature of incentive mechanisms on construction projects. They comprise goal commitment, justice and social preferences/reciprocity theory (Rose 2008).

- *Goal commitment*: As an extension to goal-setting, goal commitment (Hollenbeck and Klein 1987) refers to the sustained determination and motivation to try for an incentive goal – suggesting the way the goals of an incentive are managed over time will impact motivation and commitment. Key antecedents of goal commitment are those that impact on the attractiveness of goal attainment and those that impact on the expectancy of goal attainment (Hollenbeck and Klein 1987).
- *Justice*: The perception of fairness (or justice) regarding how and what decisions are made about reward systems can significantly affect motivation toward reward goals. There are two key justice theories relating to the fairness of decision outcomes or distributive justice and more recent work focusing on justice of the decision-making processes that lead to decision outcomes, or what is termed as procedural justice (Colquitt 2004). A third theory, complimentary to distributive and procedural justice, is interactional justice relating to aspects of the communication process between reward providers and recipients, such as honesty and respect. Interactional justice indicates that the propriety of behavior will significantly impact on motivation. Thus, the quality of the relationship between project participants impacts on perception of incentive fairness.
- *Social preferences/reciprocity*: Similar to interaction justice, economic reciprocity theory states contract agents prefer a condition of fairness in their exchange relationship. Depending on shared behavior, the value of a financial reward can be perceived to be positive or negative. Thus, if the incentive's intention is perceived to be as 'calculative' or hostile, parties may view the incentive negatively, which can lead to a hostile response (Fehr and Falk 2002).

### **Incentives in construction projects**

Incentive mechanisms have the potential to improve performance within a construction project if implemented correctly and can be introduced into any construction project contract (Bower *et al.* 2002). Incentives are generally applied to promote motivation to achieve client-specified project goals by offering either a profit sharing arrangement or a performance bonus to contract agents for above minimum performance standards. Bower *et al.* (2002) distinguish three main types of incentives in construction: share of cost saving incentives between client and contractor, schedule incentive with a premium for early completion, and technical performance bonuses for meeting other performance targets, such as quality and functionality. The general principles upon which incentive systems should be based include the need to ensure that risks and rewards are commensurably and fairly distributed among the parties concerned and that they are tailored to specific project objectives (Bresnen and Marshall 2000).

In a recent mixed method study, Meng and Gallagher (2012) found that time incentives are common practice in public sector projects. Fixed price contracts perform better on cost certainty and completion on budget than target costs, final outcome based payment and cost plus fee contracts. The use of incentives aligns the contractor's objective with the client's expectations in a project and ensures that contractors pay attention to the issues that are important for the client. Commonly, positive project performance incentives are used along with disincentives (penalties). However, it is argued that, to ensure that an adversarial relationship does not occur between the contracting parties, the incentive systems should focus on positive incentives, rather than penalties (Lahdenpera and Koppinen 2003, Rose and Manley 2011). Yet, it is generally accepted within the incentive literature that the use of multiple positive incentives

can improve overall performance while a single incentive tends to stimulate performance of particular aspect.

A multiple incentive approach suits a construction project context where there are high levels of interdependence, i.e. many project parties contribute to overall performance targets. Also, a multiple incentive approach can minimize imbalance in the contract agent priorities, for example, emphasis on target cost outcomes at the potential detriment of quality outcomes (Arditi and Yasamis 1998, Rose and Manley 2010).

### **Influence on project performance**

The use of risk/reward models and shared project risks provides an important impetus for improved project performance. In the construction industry project success is often measured by all or a few of the aspects of cost, time, quality, environmental impact, work environment and innovation (Doloi, Iyer and Sawhney 2011, Eriksson and Westerberg 2011). In defining above minimum performance standards it is important to understand how project performance is determined in a construction project context.

Project success can be affected by several aspects. Based on a literature review Eriksson & Westerberg (2011) claim that collaboration between parties is enhanced by the mediating role of joint specification, selected tendering, soft parameters in bid evaluation, joint subcontractor selection, incentive based payment, collaborative tools and contractors self-control in the procurement phase. According to Tabish and Neeray Jah (2011) the most significant factor for overall project performance in a public context is awareness of and compliance with rules and regulations. Pre-project planning and clarity in scope, effective partnering and external monitoring and control were also identified as success factors. Love, Mistry and Davis (2010) found based on interviews that trust, adequate resources, open communication, coordination, integration of top management support, creativity, and good alignments were the critical success factors for all stages of price competitive project alliances in Western Australia. Their study revealed that “the nature of the price competition model may lead to suboptimal solutions if the target outturn cost is used as a mechanism to simply win the contract” (Love, Mistry and Davis 2010: 955).

In light of theoretical constructs that underpin the design and implementation of incentive mechanisms, there are a wide range of options that can be applied to a construction project, where suitability of a specific option is context dependent. According to work motivation theory, Rose & Manley (2008, 2011) identified key financial incentive design requirements in construction that incorporate: 1) flexibility to modify goals and measurement procedures over time, 2) multiple goals covering different project areas, and 3) distribution of rewards and a valued reward level across all the key organizations contributing to team performance (e.g. potentially not just the contractor, but the subcontractors and consultants, individually and as a team). Additionally, financial incentive mechanism benefits are maximized through equitable contract risk allocation, early contractor involvement in design, value-driven tender selection, relationship workshops, and future work opportunities.

In summary, incentive reward mechanisms should be fairly applied so that rewards and measurement processes illicit their desired behaviors. These shared behaviors can heavily influence the establishment of trust and trustworthiness in ongoing project exchanges, with a notable predication that project participants will be more likely to cooperate voluntarily and reciprocate positive behavior if they jointly perceive an incentive mechanisms intention is fair and honorable. Multiple incentives mechanisms, value-driven tender, open communication,

equitable risk allocation and external monitoring and control are important ingredients for a successful incentive based project.

## METHODS

Despite the broad appliance of incentive mechanisms, empirical research on the actual effects is nascent. Next to that, contractual and actual cost data are sensitive and delicate by nature and gaining access to the essential information proved to be difficult. Case studies were seen as the best method given the complexity of project environments, and the need for in-depth understanding of the dynamics surrounding project-based motivation in order to effectively scope and identify project drivers. A qualitative multiple case study approach could enable discovering of patterns between the incentive mechanisms and project characteristics. Four case projects were deemed sufficient to derive cross-case conclusions. This number falls within the optimal range recommended by Eisenhardt (1989) and Yin (2009) of between four and ten cases. With fewer than four case studies, the empirical grounding of the research is likely to be unconvincing and with more than ten cases it can be very difficult to manage the complexity and volume of data.

The cases were considered as a rich empirical description of the particular social entities as occurring in infrastructure projects. Case studies are typically based on a variety of data sources (Easton 2010) and answer research questions that address ‘how’ and ‘why’ particularly well in unexplored research areas (Edmondson and Mcmanus 2007). Using several data sources in a particular case situation is an increasingly popular research method for studying complex organizational and business processes in construction, as for example recently illustrated by Hartmann and Bresnen (2011) on studying the transformation of partnering processes of public clients. Considering the complexity of the relation between incentive mechanisms and project performances, a cross case approach also suits our research aims.

In this paper a comparison is made of the incentive mechanisms of four integrated Design and Build cases in public infrastructure: two road reconstructions in the Netherlands and two building constructions in Australia. We selected cases from countries that are both known for their innovative market approach and high quality standard project deliveries. For this study each of the authors selected two cases that were collected in their country of origin in the context of independent research projects (Rose 2008, Scharpff *et al.* forthcoming). The selection of the cases can be considered as revelatory since they originate from a different research context and types of infrastructure. Yet, all four cases share the same innovative and incentive based character. This provided a rich data set to compare and contrast the differences in project types and the nature of project delivery across the cases, while maintaining the character of the incentive system relatively constant.

Most of the data was collected by interviews. After some general questions about the project characteristics and the outcomes, the interviews focused on the issue of goal commitment, distributive justice, process fairness and interactional justice as important motivation drivers. Examples of interview questions are: “Did you see value in the achievement of the incentive goal?”, “Was the incentive amount appropriate in terms of risks?”, and “Did you have influence over the outcome arrived by the incentive measurement procedures?”. Interview data was captured by note - taking and digital recording that was transcribed verbatim in order to develop a comprehensive database of all four cases. Informal field notes were taken that included secondary data complimented with desktop research and follow-up conversations with project

members. For all four cases the variety of different forms of data allowed for triangulation between self-report and official documents and fits the tradition of critical realism.

The cross case data analysis was based on the structure provided by the key motivation drivers of Rose & Manley (2011). This means that apart from a comparison of the contractual agreements and case characteristics, the cases were compared on the contextual drivers of incentive motivation. The contextual drivers relating to case study characteristics are as follows:

A) Contract assumptions and selection phase:

- Incentive goal opportunities: the range of goals covering key project priorities.
- Design involvement: the involvement of project parties, particularly the contractor, in the design process
- Risk allocation: how design and construction risk is allocated under the base contract.
- Value-driven tender: the nature of the tender selection process in promoting ‘value’ selection
- Future work: project stakeholder opportunities for future work

B) Execution and evaluation of contract performance:

- Reward distribution: structure of incentive reward distribution on offer.
- Incentive flexibility: the ability of the mechanism to adapt incentive design to suit changes in the project environment.
- Relationship workshops: encouraging the formation of strong project relationship and establishment of trust.

Since construction in the Dutch cases is still in progress, the research results of the Execution and evaluation phase of the Dutch cases are based on the preliminary results and expectations as expressed during the interviews.

Each case project was treated as an independent study which was subsequently subjected to cross-case analysis. Throughout data analysis and reporting the authors were frequently cross referenced between the interpretation and the original data. They regularly contacted each other to discuss the framework and share a common understanding about the cases and its context. This process can be characterized as *ex ante* use of theory in qualitative research (Andersen and Kragh 2010). The general aim of this approach is ‘not to build consensus aiming diverging theoretical perspectives but rather to use their divergences as vantage points for creating new insights’ (Andersen and Kragh 2010: 53). Since we were especially interested in commonalities and differences between the four cases and two countries, this approach appeared to suit our study.

## SUMMARY OF CASES

The following provides a summary of each of the four case studies. Highway package F (D1) and Highway A12 (D2) were civil infrastructure projects delivered in the Netherlands, while Brisbane Magistrates Courts project (A1) and the Lyell McEwin Health Redevelopment project (A2) were social infrastructure (building) projects delivered in Australia. Table 1 provides an overview on the most important characteristics of each of the four cases.

Table 1: Summary of case projects

Code	A1	A2	D1	D2
Project title	Brisbane Magistrates Courts project	Lyell McEwin Health Redevelopment project	Highway package F	Highway A12

Context	Australia	Australia	The Netherlands	The Netherlands
Project type	Large scale new court complex construction	Large scale hospital redevelopment	Large scale road maintenance on three trajectories	Reconstruction and extension highway trajectory
Contractual agreement	Managing Contractor; Design and Construction Management	Managing Contractor; Construction Management	Design & Construct	Design, Build, Finance, Maintain
Project budget	AUS\$135.5 million	AUS\$91.2 million	€108,5 million	€1.500 million
Procurement procedure	Single stage Competitive: non price criteria 70%	Two stage Competitive: non price 60%	Best Value Procurement - non price criteria 70%	Competitive dialogue – neutralized cash value registration
Start & Completion date	March 2002 – November 2004	February 2001- May 2005	June 2010 - May 2012	Construction: January 2011 – December 2015; Maintenance 2016-2036
Final client cost	\$135.5 million (GCS)	Approximately 4% below budget.	Not yet known.	Still under construction.

### **Brisbane Magistrates Courts project (A1)**

The Brisbane Magistrates Court project was a large Australian government project with a construction cost of AUS\$135.5 million (€ 97 million). The iconic building project was deemed high risk from the outset, combining a unique and complex design with high level of public scrutiny over project outcomes. The general procurement approach was a Managing Contractor – Design and Construction Management – Guaranteed Construction Sum (or ‘GCS’) arrangement. This form of procurement was chosen by the client as it allowed a high degree of certainty on end-costs through the appointed GCS. It also allowed the client significant control over design and quality as they were involved in the design process during conceptual planning, schematic design and design development and documentation stages. The project included a performance-based financial incentive mechanism of an incremental allocation from an incentive pool of AUS\$1.6 million built into the original project budget. The incentive offer was based on the completion of specific stretched-scope construction goals outside the mandatory scope of the contract. The project team managed to deliver the project on time and within client budget, meeting quality and functionality requirements. However, they failed to achieve the above ‘stretched-scope’ goals that were required for the team to receive any of the financial incentive pool.

### **Lyell McEwin Health Redevelopment project (A2)**

The project was a large Australian government acute care hospital redevelopment with a design and construction cost of AUS\$91.2 million (€65 million). This redevelopment was in response to a review of the existing facilities that were identified as not meeting their operational requirements and health service delivery models. This project included the demolition of much of the outdated infrastructure and replacement of all hospital wards. The project was undertaken via a Managing Contractor – Construction Management contract. The selected procurement approach allowed the client to control design and construction and manage construction costs through variation payments. However, under this form, the client took on the majority of cost overrun and design discrepancy risks. A key feature of the management strategy for the project was the abolition of the traditional hierarchical structure in favor of a ‘round table’ approach,

intended to promote honesty and openness in project meetings between the major parties. The incentive mechanism involved a capped financial incentive pool of AUS\$1.5 million was offered by the client and financed through the preservation of contingency amounts, which linked the client's objectives to the cost outcomes on the project.

### **Highway package F (D1)**

Highway package F is part of a portfolio of infrastructure projects meant to stimulate the Dutch economy. In this case the 'express law' made it possible to consult the market about the interest in specific renovation projects to improve the condition of the Dutch highway network and start the tender before the final permits were granted. This led to a collection of projects of which some were procured in an innovative way by applying Best Value Procurement. One of these projects is Package F, which includes adaptations to two trajectories of the A12 highway on the west part of the west-east corridor in the Netherlands and one trajectory on the A2 Highway which runs from north to west,. The project was awarded based on a D&C contract with a total budget of €108,5 million (AUS\$121 million). Most of the incentive mechanisms focused on a low price corrected by the potential traffic flows. An additional speedy delivery bonus also part of the incentive structure but this appeared to be not very influential on the final bids. After awarding the contract, on both the client and the contractor's side a full project team was operational to execute the project. The team of the client mainly focused on facilitating the contractor in providing data about the asset conditions and assessing progress of the project by external inspection. So far (June 2012) the project is running on schedule.

### **Highway A12 (D2)**

The Highway A12 project concerns part of the main traffic corridors of the Netherlands from the main ports (Airport Schiphol and the Harbour of Rotterdam) to the eastern part of the country, connecting Germany and other European countries. The project consists of reconstruction and capacity extension of the trajectory Utrecht-Lunetten-Veenendaal in the middle of the corridor, 30 kilometers of highway in total. The project contains as a DBFM contract in which the design, realization, maintenance and finances for the next 20 years has to be executed by the contractor. The goals of the project are improving the traffic flow, limiting the nuisance for the local residents and a speedy availability of the infrastructure. Part of the project belongs to measures taken by the Dutch government to boost the economy in 2009 due economic crisis. Total budget is €1.500 Million (AUS\$1.690 million). Currently a full project team on both the client and the contractor's side is operational to execute the project. The project is still under construction but preliminary results indicate a delivery far ahead of schedule.

## **RESULTS**

### **Summary of case results**

Table 2 presents a summary of case results in relation to the contextual drivers seen to impact on the effectiveness of the design and implementation of incentive mechanisms (Rose, 2008). Contextual drivers are now discussed in detail in relation to the four case studies and compared. Case study discussion is split between contextual drivers that are established at the early in an infrastructure project – or what we define as the contract assumptions and selection phase -, and context drivers that are more predominant during project delivery, or the execution and evaluation of contract performance phase. This provided the authors the ability to dissect the data

and compare results relating to specific project stages, particularly as the Netherlands projects are still under construction and part of the data is yet to emerge.

Table 2: Summary of case results

Key contextual driver/ project	A1	A2	D1	D2
<i>Contract assumptions and selection phase:</i>				
<b>Incentive goal opportunities</b> (multiple goals)	Single 'stretched scope' goal.	Multiple goal opportunities according to Ecological Sustainable Development (ESD), community relations, training and program benchmarks	During BVP procedure interviews with key persons, contractors were able to adjust their contributions during the tender.	Competitive dialogue about list of identified risks and preferred success factors of the client.
<b>Risk allocation</b> (influence on share in construction risks)	All design and construction risk allocated to managing contractor under GCS arrangement	Design risk allocated to client. Construction risk shared by client and contractor.	Almost all risks were taken by the contractor after shared risk allocation process.	Almost all were taken by the contractor after discussion in CD procedure.
<b>Value-driven tender</b> (selection based on price and non-price criteria)	Price 30%, non-price 70%: proven ability; resource strategy; project methodology; relationship management; community liaison. Two-stage tender evaluation process: panel judgment.	Two-stage tender evaluation process: 1st stage price negotiation = 40%, second stage non-price 60%: past performance, teamwork	Price 30%, Non-price; risks, opportunities, planning, capabilities key persons - partly judged by expert panel.	Performance based contract on traffic flow during construction and maintenance. Virtual value of price, risks and non-taken risks – partly judged by expert panel.
<b>Design involvement</b> (in early stage of project)	Managing Contractor appointed early to build GCS and contribute to design development	Managing Contractor and major subcontractors appointed under two stage arrangement directly to client from schematic design	D&B contract with contractor, guaranteed construction sum determined by concept design during tenders.	DBFM contract, calculations about traffic flows, sustainability and stakeholder inconvenience part of the tender process.
<b>Future work</b> (possibility for future works)	Past performance system - successful delivery of iconic project seen to directly improve opportunities for future government work.	Client offer for managing contractor and key consultants to be reappointed for ongoing project stages if they achieve high performance	Limited competition; selection requirements did not exclude certain parties. Currently implementing past performance system.	No actual need for past performance since only few parties in the market that quality for large projects.

<i>Execution and evaluation of contract performance:</i>				
<b>Reward distribution</b> (influence on reward allocation, self-assessment)	Exponential payment of incentive reward based on completion of stretched-scope construction goals. Contractor reward only.	Capped financial incentive pool of AUSS\$1.5 million financed through the preservation of contingency amounts. Pool allocated according to performance in ESD, community relations, training and program performance based on fee proportion	Shared risk fund: 25% of remainder is for contractor. Contractor responsible for assessment reports. This enables trust between client and contractor.	CD procedure resulted in agreed allocation of risks and reward scheme during construction. Maintenance: yearly fee based on traffic flows
<b>Incentive flexibility</b> (possibility to adjust after tender)	Minimum flexibility	Flexible through consensual agreement	Minimum flexibility after final bid	Joint agreement on flexibility within contractual terms
<b>Relationship workshops</b> (formal and informal workshops and reviews)	Initial relationship workshops and relationship management requirements as a part of project agreements.	Relationship consultant appointed to conduct relationship workshops. Ongoing relationship monitoring in a project workgroups defined as a project objective.	Procurement method included team based selection via interviews with key persons. Performance based contract informing the client about progress based on external reviews.	Competitive dialogue during selection increased common understanding. Project start up, regular project meetings and open communication via functional and technical requirements

## Results on selection phase and contract assumptions

### *Incentive goal opportunities*

Management literature emphasizes the importance to ‘balance’ incentive goal parameters to prevent overemphasis on particular goals, where setting multiple goals and incentive reward levels ensure that goals remain achievable and credit is given for partial success. According to the Australian case project results, A1 had a single incentive goal, while A2 had a wide range of performance goals. The results from A1 indicated project participants felt that the single stretched-scope goal was too restricted, and did not take account of their performance in the key project priority areas. For example, according to the contractor representative on the project, the single incentive goal “wasn’t enough to really measure the achievements on the project. I think if we had of been offered more of a reward in other areas it could have pushed us further.” The perceived injustice in the development of the goals early in the project resulted in its failure. Again, this was opposite in A2, where multiple incentive goals gave the project participants considerable control over their performance, as there was a wide range of opportunities to secure the financial incentive.

In both project D1 and D2 there were opportunities during the selection phase for the contractors to share their plans and goals with the client. The Best Value Procurement method of project D1 included interviews with key persons. These interviews provided the basis for the performance based contracts. In D1 the tender candidates especially expressed a need for more clarification on the award criteria and actual aim of the client for the project, e.g. sustainability or

continuous traffic flows. In the competitive dialogue of case D2, the list of predetermined risks and success measures was discussed in detail between the client and the contractor before the contractors offered their final bids. This enables both parties to take indistinctness about the project goals out of the air in a relative early phase of the project and improved the sensemaking processes between the client and the contractor. According to the contract manager this eventually “led to a good feeling about the submitted bids”.

#### *Design involvement*

A major difference between the Netherlands civil and Australian building case projects was the greater emphasis on the design stage in building projects. As such, participants involved in the building projects placed much greater emphasis on the involvement of the contractor and key subcontractors in the design stage, as design discrepancy risks can be potentially higher in building projects in comparison to civil road projects. In road infrastructure it is possible to define a relatively simple performance measurement system or parameters for the success of qualitative aspects, e.g. the traffic loss hours or amount of failures, since the safety and technical requirements are pretty much pre-defined. In architecture everything is adopted to its context.

According to the results from project A2, the involvement of the managing contractor and key subcontractors in design development was seen to improve the project team’s ability to manage the integration of design and construction by providing buildability advice. According to the project client this assisted the team to “find building smarts that would improve the value of the project - and gave ‘a good indication of what [the team] were aiming for in terms of cost reduction’”. Project A2 also uniquely involved key subcontractors in the design stage, which was seen to improve the managing contractor’s effectiveness in identifying value-added design options. On the other hand, project A1 was plagued with quality of documentation issues that were attributed to late contractor involvement in design. These issues may have been resolved if the managing contractor had been involved in design earlier, minimizing the level of design rework required during design documentation.

Project D2 involved competitive dialog during the selection phase, encouraging the discussion of concept designs with the client and award based on the expected traffic flows, sustainability and level of stakeholder inconvenience. This opened up the discussion about different construction methods with innovative solutions to increase the construction speed. The contract manager of the client indicated that “most of the questions related to the qualitative elements instead of the bolt and nuts” which shows a different focus on the bidders. Project D1 was awarded based on a D&B contract, which included only a small portion of design and a lot of construction because of the large share of maintenance activities. However, due to innovation in the design of the construction processes (e.g. permit permission, adjusted design solutions) it was possible to accelerate the delivery of the project. In this sense, the procurement method opened up the possibilities to include the design in the construction in both cases, which is quite unique in economic infrastructure projects.

#### *Risk allocation*

In all cases the allocation of risk under contract arrangements impacted on the implementation of the incentive mechanisms. In case A1, the managing contractor took on a greater share of construction cost risk in comparison to A2 under different contract forms. According to the participants involved in project A2, the client’s willingness to share construction cost risk was seen to improve the managing contractors’ ability to achieve the incentive goals, as they were less likely to be focused on their own financial liabilities, and more likely to perceive the client behavior as fair. For example, the managing contractor perceived the

client’s willingness to share construction risk “broke down the ‘us versus them’ attitude which is prevalent in [traditional] contracts and focused our joint attention on achieving the project goals.” On the other hand, the A1 project participants acknowledged that the contractor resorted to a self protective position due to their high risk liability, partly resulting in an unwillingness to pursue the stretched scope incentive goals.

In the tender phase of D2 a list of previously identified risks and opportunities were made available. According to the project leader the contractors could thus decide for themselves which of these risks were to be part of their job description. After submission of the final bids it appeared that most of the contractors “took most of the risks”. This was probably due to the competition in the market and the expectation that other contractors would also allocate these risks towards themselves. Project D1 included a shared risk fund. In case of unexpected events, the contractor was allowed to solve the problems based on actual costs +5% cost markup. The contractor was entitled to 25% of the remainder of this fund after delivery of the project. This way the contractor was stimulated to create preventive measures in the early phase of the project that would leave the risk fund untouched, which actually happened. Preliminary results indicate that this risk fund contributed to the project culture in which not every detail and possible additional costs are discussed. Yet, in D2 the client project leader indicated that so far hardly any unforeseen costs have been filed to “apparently you don’t need a shared risk fund if the arrangements are just”.

*Value-driven tender*

All case projects involved some form of non-price criteria that encouraged selection based on value in comparison to price alone. Both A1 and A2 had relatively high non-price proponents, with project A1 affording a 30% price and 70% non-price split, and project A2 with a two-stage 40% price and 60% non-price split. Non price criteria included proven past performance and ability; resource strategy; project methodology; commitment to relationship management; and community consultation. According to both project A1 and A2 results, the selection of project participants based on their ability to add value to the project (rather than the traditional price-focused tender selection) increased the project participants’ expectations that incentive goals could be achieved, promoting commitment. It was also seen to encourage a willingness to align with the team objectives and meet the client expectations by which they were selected.

In the Netherlands cases, both D1 and D2 were awarded based on the Economically Most Advantageous Tender principle. In D1 the price/quality ration was 30/70, in which the quality included the allocated risks, the offered opportunities, the planning, and the capabilities key persons as tested during an interview. Within the tender process of project D1 an incentive mechanism successfully prevented the contractor from offering an unrealistic price. In case the target price differed more than 5% from the final fixed price, this was deducted from the shared risk fund. No deviations meant a ‘no claim’ bonus of 2.5%. An internal comparison of project D1 with 9 other projects showed the most of the winners scored first or second in rank on quality (traffic flow, planning). They also found that the price - quality ration should be equal or more towards quality to prevent opportunistic behavior and make value-driven tenders effective. In D2 the contracts were awarded based on the virtual value of the price and risk allocation. This required the judgment of expert since not all aspects were quantified easily. Not all judgments were made by this expert panel since “previous experiences showed that the bidders were a bit nervous about the qualitative aspects of this judgment” (project leader client). The results of D2 indicate that during the competitive dialogue the contractors assigned more value to the informal

conversations than the formal conversations. This shows the relevance of information contacts in building a successful relationship between client and contractor.

#### *Future work*

The results from the Australian case projects identified that due to a highly competitive local building construction market the desire to uphold and improve reputation, so as to increase future commercial opportunities, was a strong motivator to pursue incentive goals. This was particularly relevant to Australian government projects, where state governments are major repeat clients. It is likely that the desire to strengthen reputation with these clients would be stronger than with clients who are less likely to provide further work opportunities. The strength of this driver was particularly evident in the project outcomes for project A2, where the key project participants were offered the opportunity to be reappointed to ongoing stages of the hospital redevelopment program if they achieved high performance. This strongly intensified the desire to achieve the incentive targets outside the financial reward on offer where the contractor was “driven to maintain the good relationship with the government client so [they] would be looked on favorably in future projects...as valued reward outside the [financial] incentives.”

Project D1 and D2 were both relatively large highway infrastructure projects as part of the governmental strategy to support the construction industry in surviving the credit crunch. Since the Dutch economic infrastructure market has only a limited amount of competent players in this segment, pre-selection of the contractors usually focuses on financial requirements to ensure the business case. So in D1 and D2 the selection requirements did not lead to exclusion of certain parties. A comparative study between the other projects that belonged to the portfolio which included D1 did show that the larger contractors had won more tenders than specific combinations of small contractors. A need still exists to offer contractors that outreach other contractors increased chances of winning a tender. Therefore several infrastructure providers in the Netherlands are currently implementing past performance system to make it possible. This would enhance a collaborative environment between client and contractor.

### **Results on execution phase and evaluation of contract performance**

#### *Incentive flexibility*

Due to the often high level of uncertainty and complexity within large infrastructure projects, it is difficult to predict, at the commencement of the project, the events that will occur during delivery that may alter project outcomes. Therefore, project design features should remain relatively flexible to meet changing project circumstances. This sentiment can also apply to incentive mechanisms where it may be important to adjust reward structures at the post contract stages in order to achieve performance targets when faced with uncertainty.

The Australia research results emphasized the importance that goals and measurement processes should be as flexible as possible to ensure that unforeseen events do not render the incentive measurement benchmarks unattainable. This occurred in Case A1, where the ‘stretched scope’ goals were not pursued because of the financial pressure faced by the managing contractor under the GCS arrangement. This was opposite in Case A2, where the incentive goals were adjusted to align with emerging project priorities resulting in higher performance by the end of the project.

Since the Dutch cases were still in the construction phase, the results of the incentive structure are not fully available yet. However, a preliminary evaluation of the tender procedure of D1 showed that most of the costs incentives were reached without further adjustments. Next that that only limited additional costs were needed to complete the project. In D2 the contractor

decided to make use of the possibility to deliver the road earlier as planned and thus saving money by early payment. The client project leader indicated that during the construction “some issues that officially might not have been part of the contractual agreements were solved in consultation with the contractor”. This kind of behavior caused a certain kind of flexibility in the contractual arrangements which supported the process of “searching for win-win situations” within the contractual boundaries.

#### *Reward distribution*

In relation to reward distribution A2 project results suggested that the project participants valued the client’s decision to allow the project team to decide how the incentive amount would be distributed. It was jointly decided that the bonus pool incentive would be distributed according to fee proportions as the contractor was remunerated under a ‘construction management’ fee arrangement. According to a project consultant representative, “this was a fair way to [distribute the reward] and let the team decide how it would be allocated [to] the managing contractor, consultants and key subcontractors based on fee percentages.” On the other hand, A1 only offered the incentive reward to the managing contractor to the disappointment of consultants and key subcontractors who were seen to contribute to pursuing the stretched scope incentive goals. The research results suggest the financial incentive distribution plan should be equitable in how it rewards the major parties who contribute to the incentive goal performance outcome, including consultants and subcontractors.

Both Dutch cases used the measure of self-assessment to agree upon the distribution of the rewards. This meant that the contractors had to take care of their own inspections of the work and invite third parties to provide second opinions about specific additional measures that could require additional funds. In D1 the shared risk fund allowed the contractor to “pick their battles” with the client. The preliminary results indicate that this way of working stimulated the contractor to only address the serious issues that arose. The contract manager indicated that compared to traditional projects not much activities had to be performed that were out of the project scope and requiring additional funds. For D2 so far no real issues have risen about performances and payments. In case deviations appeared to occur, these were openly discussed during the regular meetings. The final outcomes were filed in management system that is also used for the performance measurements.

#### *Relationship workshops*

Although each case project had varying relationship development processes, it was evident from projects A1 and A2, the initial relationship workshop and informal relationship monitoring induced commitment towards achieving shared incentive goals, encouraged collaboration and promoted trust. Specifically, the procurement approach in A2 placed greater emphasis on the development of the project relationship, with more intensive relationship workshops than in A1 (which had only one relationship meeting after the managing contractor was engaged). The comparisons between these projects suggest that the greater the level of team building developed through ongoing relationship workshops, the greater the willingness of participants to pursue incentive goals.

In D1 the composition of the contractor team was part of the tender bid. The Dutch client applied Best Value Procurement method comprised interviews with the future project leader and main team members. The contractual agreements included a clause about continuous commitment of these team members during the complete project. This method can be considered as an early relationship workshop. Additionally, the first six months after award of the contract were spent on collaborative design activities and the project aims were extensively discussed

during a Project Start Up session. Hence, the results of an evaluation report indicated that the close contact with the contractor decreased after the tender phase. Therefore it can be concluded that more workshops in the early execution phase and regular formal assessments would have been beneficial. In D2 the client organized a Project Start Up to get the contractor acquainted with the culture and procedures of the client organization. Especially in the beginning the client project manager indicated that they tried to “teach them to understand our environment and show our trust in their capabilities and intentions”. Because D2 is still under construction the official effects of the interactive procurement method are not available yet. However, preliminary results indicate that delivery will be four months ahead of schedule, additionally to the 1,5 years that were accomplished during the tender.

## CONCLUSION

The effectiveness of an incentive mechanism to promote the achievement of shared goals is highly sensitive to the context in which it is applied, particularly in complex social environments like construction projects. Thus, effective incentive design requires a clear understanding of the impact of different delivery strategies and environmental contexts on incentive goal motivation. Drawing on the results of two Australian social infrastructure (building) case projects and two civil infrastructure projects from the Netherlands, differences and similarities in key contextual drivers were explored. It was identified that despite significant differences in the project characteristics across the two countries, results indicate they experience similar contextual drivers impacting on the incentive effectiveness.

Of note, high value was placed on equitable contract risk allocation in support of the incentive and the quality of project relationships promoted by relationship workshops and interaction during and after the selection process. These findings indicate that the development of project relationships (mediated through formal governance mechanisms) has a major impact on the success of incentives, despite differences in project characteristics. All cases were value driven tenders in which price was to be of lower importance than non-price criteria, which enabled the use of performance based incentive mechanisms. In all cases, the organizational structure aimed at encouraging the formation of trust across organizational boundaries and open communication about issues that emerged from the dynamics of construction.

On the other hand, three contextual drivers were seen to be different across the Australian and Dutch contexts. They were: 1) the opportunities for future work, 2) design involvement, and 3) incentive flexibility. This was primarily related to the differences between the two sets of projects. Firstly, future work opportunities were identified to be a more powerful driver in the Australian building context due to a highly competitive building construction market in comparison to the Dutch market, who have limited amount of players in road construction. This means that the Dutch client recently decided to decrease the pre-selection requirements. It is interesting to note that the Dutch client is currently developing a past performance system to enhance collaboration and trust with their contract parties for all infrastructure projects (road, rail and real estate).

Secondly, the impact of design involvement and incentive flexibility seems to be more pronounced in the Australian building case projects in comparison to the Dutch road construction case projects. This may be due to a higher level of design complexity in building construction, introducing higher design and performance discrepancy risks. Similarly, in civil projects architectural design aspects are less prominent than in building projects, which also show in the character of the incentive schemes and goal opportunities implemented across the two sets of

case projects. Yet, the increase of software issues (traffic management, tunnel safety etc.) in infrastructure project may give reason for more incentive flexibility and design focus.

So although there are limitations with this research in drawing generalizations across two sets of diverse case projects, the results provide a strong base to explore incentive systems across different geographical and contextual boundaries in future research. Despite this contribution, future research is required to further explore the causal relationships between incentive outcomes and project related and contextual characteristics, including cultural differences across cases. This collaborative research is planned by the authors and is expected to provide greater clarity on the nature of incentive drivers across broadly different contexts, building upon the results presented in this paper.

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### REFERENCES

- Andersen, P. H. and Kragh, H. (2010) Sense and sensibility: Two approaches for using existing theory in theory-building qualitative research. *Industrial Marketing Management*, **39**(1), 49-55.
- Arditi, D. and Yasamis, F. (1998) Incentive/disincentive contracts: Perceptions of owners and contractors. *Journal of Construction Engineering and Management*, **124**, 361-73.
- Bower, D., Ashby, G., Gerald, K. and Smyk, W. (2002) Incentive mechanisms for project success. *Journal of Management in Engineering*, **18**, 37-43.
- Bresnen, M. and Marshall, N. (2000) Motivation, commitment and the use of incentives in partnerships and alliances. *Construction Management and Economics*, **18**, 587-98.
- Colquitt, J. A. (2004) Does justice of the one interact with the justice of the many? Reactions to procedural justice in teams. *Journal of Applied Psychology*, **89**(4), 633-46.
- Doloi, H., Iyer, K. C. and Sawhney, A. (2011) Structural equation model for assessing impacts of contractor's performance on project success. *International Journal of Project Management*, **29**, 687-95.
- Easton, G. (2010) Critical realism in case study research. *Industrial Marketing Management*, **39**(1), 118-28.
- Edmondson, A. C. and McManus, S. E. (2007) Methodological fit in management field research *Academy of Management Review*, **32**(4), 1155-79.
- Eisenhardt, K. M. (1989) Building theories from case study research. *Academy of Management Review*, **14**(4), 532-50.
- Eriksson, P. E. and Westerberg, M. (2011) Effects of cooperative procurement procedures on construction project performance: A conceptual framework. *International Journal of Project Management*, **29**, 197-208.
- Fehr, E. and Falk, A. (2002) Psychological foundations of incentives. *European Economic Review*, **46**, 687-724.

- Hartmann, A. and Bresnen, M. (2011) The emergence of partnering in construction practice: An activity theory perspective. *Engineering Project Organization Journal*, **1**(1), 41-52.
- Hollenbeck, J. R. and Klein, H. J. (1987) Goal commitment and the goal-setting process: Problems, prospects and proposals for future research. *Journal of Applied Psychology*, **72**(2), 212-20.
- Lahdenpera, P. and Koppinen, T. (2003) Charting of incentive payment bases for multiobjective construction projects. *In: Joint International Symposium of CIB Working Commissions*, 22-24 October Singapore. International Council for Research and Innovation in Building and Construction, Vol. 1, 481-93.
- Love, P. E. D., Mistry, D. and Davis, P. R. (2010) Price competitive alliance projects: Identification of success factors for public clients. *Journal of Construction Engineering and Management*, **136**(9), 947-56.
- Meng, X. and Gallagher, B. (2012) The impact of incentive mechanisms on project performance. *International Journal of Project Management*, **30**(3), 352-62.
- Mitropoulos, P. and Tatum, C. B. (2000) Forces driving adoption of new information technologies. *Journal of Construction Engineering and Management*, **126**(5), 340-8.
- Rahman, M. M. and Kumaraswamy, M. M. (2004) Contracting relationship trends and transitions. *Journal of Management in Engineering*, **20**(4), 147-61.
- Rose, T. and Manley, K. (2010) Client recommendations for financial incentives on construction projects. *Journal of Engineering, Construction and Architectural Management*, **17**(3), 252-67.
- Rose, T. and Manley, K. (2011) Motivation toward financial incentive goals on construction projects. *Journal of Business Research*, **64**(7), 765-73.
- Rose, T. M. (2008) *The impact of financial incentive mechanism on motivation in Australian government large non-residential building projects*, PhD thesis, School of urban development & faculty of built environment and engineering, Queensland University of Technology.
- Scharpff, J., Volker, L., de Weerd, M. and Herder, P. M. (forthcoming) Designing a dynamic network based approach for asset management activities. *In: ARCOM 2012*, 3-5 September, Edinburgh.
- Tabish, S. Z. S. and Neeraj Jha, K. (2011) Identification and evaluation of success factors for public construction projects. *Construction Management and Economics*, **29**(8), 809-23.
- Van Herpen, M., Van Praag, M. and Cools, K. (2002) *The effects of performance measurement and compensation on motivation (discussion paper # 03-048/3)* Tinbergen: Tinbergen Institute.
- Verma, K., Mitnick, B. M. and Marcus, A. A. (1999) Making incentive systems work: Incentive regulation in the nuclear power industry. *Journal of Public Administration Research and Theory*, **9**(3), 395-436.
- Yin, R. K. (2009) *Case study research: Design and methods*. 4 ed. Vol. 5, *Applied social research methods*, Beverly Hill, Cal.: Sage Publications.