Relationship between Early Contractor Involvement and financial performance in the Rebuild of Christchurch's Infrastructure

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Word count: 5432 **words text + 6 tables/figures x 250 words (each) = 6932 words**

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Submission Date: July 31, 2014

ABSTRACT

Alliance contracting is a partnering project or program delivery method where all parties work collaboratively to share risks. The Stronger Christchurch Infrastructure Rebuild Team (SCIRT) alliance has been set up to manage the high risk of the unknown scope of works associated with disaster recovery projects after the 2011 Earthquakes in Christchurch, New Zealand. SCIRT utilizes early contractor involvement (ECI) as a key measure for risk mitigation and to offer value for money. ECI provides for constructability input during the design process ensuring that any issues and construction risks are identified early and taken into consideration. Since there was considerable pressure to get the rebuild started not all SCIRT projects have had the benefit of ECI. With the objective of quantifying the positive effect that ECI has on the financial outcomes, 288 projects that were in construction or had been finished at the end of February 2014 have been compared. The comparison was based on whether ECI was used during the design phase and whether it had been used in the cost estimation of the project. The results clearly show that there is a significant improvement in cost performance and cost accuracy of the reconstruction projects undertaken across the alliance program that had received ECI input.

Keywords: Early Contractor Involvement, Alliance Contracting, Cost performance

INTRODUCTION

Following the first earthquake on September 4, 2010, Christchurch City suffered a substantial amount of damage to its infrastructure. An emergency response program was put together by the City Council and referred to as the Infrastructure Rebuild Management Office (IRMO). Under this arrangement the city was divided into four geographical areas with each area allocated to a civil construction company to manage design and construction of the repair works. A second large earthquake on February 22, 2011, resulted in the loss of 185 lives, extensive damage to buildings and houses, wide-spread liquefaction and a significant increase in the amount of damage to the city's already damaged infrastructure. The extent of the damage and the resulting increased need for resources meant that a different delivery model was needed to manage and co-ordinate the rebuild. The need to combine resources and share knowledge (*1*) to ensure that the damaged infrastructure would be reinstated as quickly as possible (*2*) and that the rebuild could be completed within a 5 year period (*3*) combined with the risk associated with the unknown scope of works (*4*) and further seismic activities, made an alliance the ideal program delivery model.

Alliance contracting has previously been used as a delivery model where organizations work collaboratively by sharing responsibility and risk (*4*). The alliance approach to project delivery is basically a different way of targeting project outcomes and sharing risk. Initially the alliance model was of a form that is now commonly known as the 'pure' alliance. This model has been widely investigated and reported on (*5, 6, 7, 8, 9, 10, 11 and 12*). More recently other variants of the alliance model have been implemented which differ significantly from the 'pure alliance' model, offering a project delivery model that can be suited to different situations (*13*).

One of the benefits of the alliancing approach is having access to construction personnel during the design phases of the project to help make more informed decisions to optimize the design and to manage risks (*14*). In the SCIRT Alliance, contractor involvement is provided by the contractors in a structured process to provide the design teams with constructability advice, ensuring that any issues and construction risks are identified and taken into consideration early in the design process (*15*). Another objective of early contractor involvement is to ensure that the project costing is well informed in terms of a safe methodology and that any identified construction risks are properly assessed.

Disaster recovery projects are comparable with major infrastructure projects (*2*) and to date major infrastructure projects have a history for incurring cost overruns, which are often due to ineffective risk management and the lack of accountability (*16*). In the US, the Construction Industry Institute (*17*) stated that partnering offers opportunities to improve the cost effectiveness of construction projects and in the UK, Latham (*18*) argued that partnering could reduce costs as well. Several authors have identified commitment to partnering from all involved parties, early involvement of contractors during the design, the identification of risk, trust and relationships, as key factors for mitigating risk and also the success of target cost projects (*19*, *20* and *21*). But no research has been found that quantifies the effect of the factors on cost certainty or lowering the cost of alliancing. In present research the financial data from 288 projects that are in construction, handover and practical completion are used to illustrate how the involvement of contracting input early in the design process in an alliance affects the final cost outcome and cost certainty of the projects.

SCIRT ALLIANCE

In New Zealand, SCIRT has been set up as a multi-client multi-contractor alliance (*13*) in September 2011. The alliance is responsible for assessing the infrastructure network for earthquake damage and managing, coordinating, prioritizing, designing, estimating and delivering the various work packages that are needed to rebuild Christchurch's damaged infrastructure. SCIRT consists of the following eight parties. The local council, central government and the New Zealand transport agency are the owner participants and funding agencies, while five of New Zealand's largest civil engineering construction companies are the non-owner participants (*3*). All other companies or individuals that cooperate in the infrastructure rebuild are employed by SCIRT but are not part of the alliance.

The Alliance consists of a board, a management team and an integrated services team (IST) which are shown in Figure 1. The board consists of the CEO's of the participants and oversee the management team that manages the day-to-day operations; both the board and the management team are formed by staff seconded to SCIRT from the participants. The integrated services team (IST) is made up of specialists like quantity surveyors, designers, planners and asset managers which provides all asset assessment, project prioritization, concept design and detailed design services. These specialists are either seconded from the participants or selected through a request for professional services procurement process. During peak times there were 270 full time staff employed in the IST offices. Since the earthquakes were a national disaster and all companies were keen to participate, there was no difficulty in finding staff.

One of the responsibilities of the IST is to determine the target cost (*13*) for each project independently from the construction companies. The independence is set up to ensure that fair trade practices are followed. In alliancing the target cost is referred to as target outturn cost (TOC) and in SCIRT it represents the estimated physical construction cost and on site supervision only. Other costs like the design costs are paid on a cost reimbursable basis to the design companies and form part of the total project cost to the client but are not included in the project TOC in SCIRT. This differs from the calculation of the TOC in other alliances where direct project costs like design are also part of the TOC (*13*).

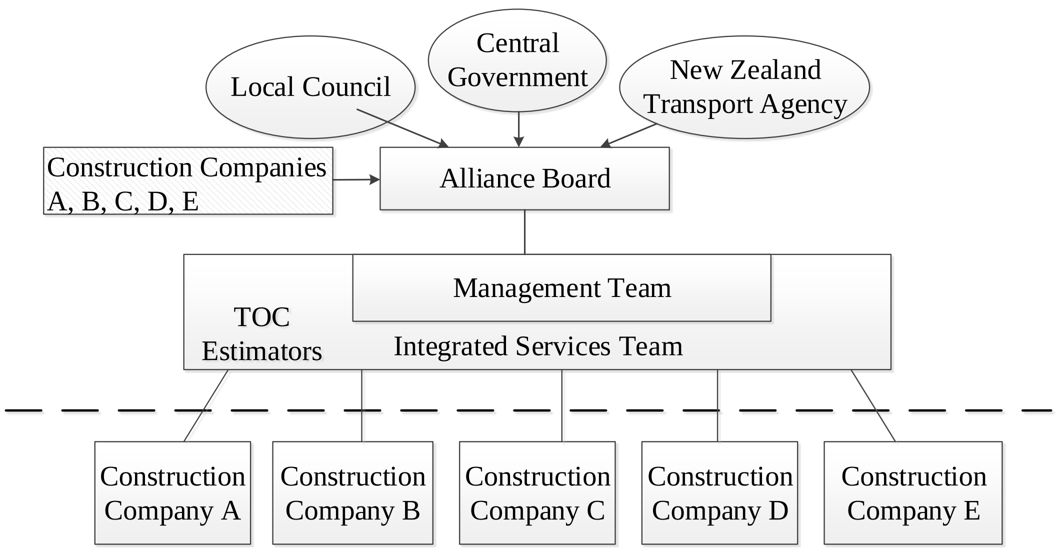

FIGURE 1 SCIRT Alliance organizational structure

The rebuild of the city's infrastructure is scheduled to be completed in December 2016 and is referred to as the program of works. The infrastructure includes asset types like national and council owned roads and bridges, water supply reticulation and water storage reservoirs, waste water reticulation and pump stations as well as storm water reticulation and pump stations. The program is divided into smaller projects, each identified with a unique project number. Each of these projects is designed by one of the design teams, who are embedded in the IST. After a project has been estimated for cost, the project is allocated to one of the construction companies for construction. In SCIRT the construction companies have set up offices for their delivery teams apart from the IST (*3*). This seems counter intuitive for an alliance (*14*) however only the actual construction teams are located in the separate offices and there still is a lot of collaboration with the designers and other IST staff during construction. In figure 2 the process of a SCIRT project life cycle is displayed. Every stage of the cycle is called a 'gate'.

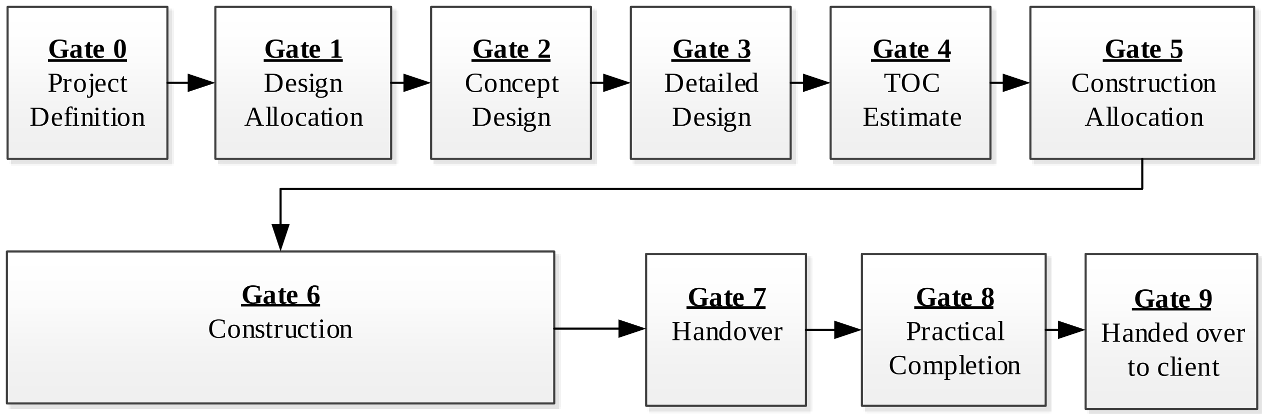

FIGURE 2 SCIRT linear gated project life cycle

Each of the projects is delivered on a cost reimbursable basis with a pain/gain share agreement. According to this agreement the sum of all cost savings and cost overruns of the projects will be split between the participants of the alliance at the conclusion of the SCIRT program. This pain/gain sharing is capped at the amount of the indirect costs of the contractor (*14*), which means that the contractors are always paid the direct project costs, but could lose or gain an amount equal to the profit plus corporate overheads margins.

The SCIRT alliance has been set up to reward good performance with an increase in allocation of the future work load. The future work allocation is based on a delivery performance score (DPS) that is calculated using the financial performance of each delivery team's projects against TOC as well as the performance against several non-cost key performance area (KRA's). The DPS has been set up to create price tension between the delivery teams in a collaborative environment to provide the client organizations with value for money (*3*, *13*).

The construction work has been prioritized generally by starting with the most critical and deepest and most expensive asset first i.e. the waste water reticulation network which is followed by roading, water supply and storm water assets. Existing sewer catchment areas have been used as identifier for repairs to all assets in a particular area of the city. Work has also been designed in this order, starting with the waste water reticulation and pump stations for each catchment, followed by the roading packages and other assets in the same area.

Early contractor involvement (ECI) in SCIRT

In the SCIRT rebuild program each delivery team should have a dedicated ECI manager work collaboratively with the design teams to provide constructability input into the design to ensure all construction risks have been taken into consideration (*15*). This is achieved through regular meetings as well as risk and constructability workshops. These interface meetings are led by the ECI manager from the delivery team who is also responsible for ensuring all key milestones are met.

At the end of the detailed design phase the ECI manager is responsible for submitting the required deliverables for consideration to the IST estimator who is pricing up the work. The required key deliverables are methodology, traffic staging details, construction schedule in bar chart format, an updated risk register and an inspection and test plan (ITP). It is also the responsibility of the ECI Manager to review the bill of quantities prepared by the designers to confirm that it accurately reflects the scope of works and also ties in with the proposed methodology to construct the work safely. (See table 1 for key roles and responsibilities during ECI). The three key roles in the ECI are the leader of the design team, the project manager or delivery lead as leader of the construction team and an ECI manager.

On completion of the detailed design of a project, after the submission of the ECI deliverables and design documentation, the IST estimator, the ECI Manager and an independent (external) estimator arrange a handover meeting during which the project is discussed and any concerns or differences on methodology are resolved and agreed. The independent estimator is employed directly by the owner participants of SCIRT and is not part of the alliance. During the handover meeting the discussions are around methodology, duration and risks and any discussion around price is prohibited, to ensure the independence of the TOC and to prevent any direct influence from the delivery teams. After this meeting the TOC for the project is estimated by the resident IST estimators.

TABLE 1 Key roles and responsibilities during ECI

ECI Team member	Responsibilities
ECI Manager from delivery team	• Lead and chair ECI team interactions • Ensuring key dates are met • Review of Bill of Quantities
Design Lead	• Identify and communicate design parameters and issues • Evaluate input from delivery team and integrate modifications as required to the design and risk register
Delivery Lead/ Project Manager	• Communicate construction methodology and any associated issues • Required to evaluate input from designer and make modifications as required to the methodology and risk register

The TOC is determined from a first principle build-up using material supply pricing from the market and plant and labor rates as agreed with the independent estimator. The independent estimator signs off each TOC once alignment is reached following a parallel estimating process (*3*). The presence of an independent estimator in this process serves to ensure that the right procedures are followed and the TOC has been set correctly. Once the TOC has been signed off and the project is allocated to a delivery team for construction, the TOC can only be adjusted through an approval process referred to as work scope change (WSC). WSC's are only approved for design changes, client instructions and project definition changes.

This ECI process provides the delivery teams with the opportunity for early construction planning and an opportunity to understand the project and plan for construction. In figure 2, ECI would involve collaboration at gates 2, 3, and input at gate 4. Final allocation of the project to a delivery team occurs after the TOC has been set (gate 5), providing ECI input during the design of a project is no guarantee that the project will be allocated to the delivery team who provided this ECI input.

DEFINED PERIODS WITHIN THE PROGRAM OF WORKS

With the quick transition from disaster to rebuilding the infrastructure, three distinct periods within the program of works could be identified to date i.e. transition, ramp-up and steady state. A fourth period will occur gradually across the program which is the ramp-down. During this period staff and contractors will transition out of the rebuild program back to a "business as usual" environment. Each of these periods has some unique characteristics that have significantly impacted on the financial performance across of the program of works.

Transition Period

After the signing of the alliance agreement in September 2011, all the projects identified under the previous delivery program, IRMO, were transferred to SCIRT. Projects with designs that were either completed or well advanced were estimated and constructed under the SCIRT alliance commercial model. These projects were prioritized for construction during the transition period which lasted from October 2011 to February 2012. The projects were mostly water mains although also the first of the gravity waste water projects was estimated and delivered during this period.

During the IRMO period, the projects had been procured on a basis similar to a typical design build project, where each contractor had independently engaged and managed a design consultancy to provide the professional design services. The designs were therefore well informed; the identified construction risks were well developed and incorporated into the design and construction methodologies.

Ramp-Up Period

SCIRT has an obligation to complete the program of works within a set period of time (*3*). In order to achieve this, a certain volume of work was scheduled to be completed per month across the program. This in turn required every gate in the process to meet a minimum monthly target. During the ramp-up period, from March 2012 through to October 2012, a greater number of complex projects were designed than during the transition period. These were typically large diameter pressure mains, waste water pump stations and civil structures such as bridges. In order to meet the program completion date of December 2016, a minimum monthly construction spend was required. Due to the increase in project size, a lack of resources from delivery teams while the systems and procedures in the IST were still being developed, ECI input during the design was limited. During this period there were few formal risk and constructability workshops as everyone focused on constructing the work packages in the field.

Steady State

As the staff became more familiar with the SCIRT processes and business systems were developed, ECI input became a formalized and documented process. During the current steady state period, from November 2012 to date, there has been an increased focus from SCIRT on improving the constructability input into the design and informing the independent TOC development as per the ECI guidelines.

Projects designed during this period, had risk workshops and constructability workshops that were attended by the nominated ECI team to provide constructability input into the design and ensuring that all construction risks had been identified and mitigated where possible. During the steady state period, formal handover meetings and site visits were scheduled with the IST estimator to ensure that the methodology and risks are understood and taken into consideration for TOC development.

METHODOLOGY

An analysis has been done on the monthly financial data of all 288 projects of SCIRT that were in construction, handover, practical completion or were handed over to the client (gates 6-9, see figure 2) by the end of February 2014. The available project data contained the program period, delivery team name, present status of the project, planned completion date, date TOC deliverables were submitted, original TOC value, revised TOC value (adjusted after approved work scope changes), cost to date and forecast final cost. The forecast final cost is the sum of the total cost paid to date and the cost to complete the remainder of the works (according to the project manager).

In the analysis the mean project cost outcomes are calculated for projects grouped based on two variables. The first variable is the timing of the project, or during which of the defined periods of the program the project was designed and constructed. The second variable was the ECI input, whether the project had either no ECI deliverables handed in, had the ECI deliverables late or had ECI deliverables handed in on time.

The results of the quantitative analysis have been verified through discussions with the SCIRT risk manager, members of the SCIRT management team and with delivery team members. Although some factors may have affected individual project outcomes, like procurement of subcontractors, experience of certain staff, or risk events that may have occurred on site, it is assumed that these effects are averaged out due to the large number of projects that was used in the analysis.

Data Analysis

All statistical analyses were performed using SPSS version 20. A normality test of the mean cost overruns as the dependent variable per period of projects with deliverables submitted has been performed and was found to be approximately normally distributed using the Normal Q-Q plot. A univariate analysis of variance was calculated and the estimated marginal means of the cost overrun per period in the program were analyzed in order to assess the financial impact of ECI input on the estimate of the TOC for each project. The project cost outcomes are calculated as a percentage of TOC, conform following equation,

$$\text{project cost} = \frac{\text{Forecast Final Cost} - \text{TOC}}{\text{TOC}} \quad (1)$$

A positive outcome indicates there was a cost overrun and the project is said to be in 'pain', while with a negative outcome indicating a cost saving (cost underrun), the project is said to be in gain.

RESULTS AND DISCUSSION

The 288 projects are divided into 3 distinct time periods, transition, ramp-up and steady-state. Over these periods the project size increased steadily (See table 2 for mean period project sizes).

TABLE 2 Average project size (in millions $) per period in the SCIRT program

Program Period	Number of Projects	Mean Project size (M$)
Transition	*55*	*0.59*
Ramp-up	*94*	*2.03*
Steady-State	*139*	*3.79*
Total	*288*	*2.60*

From the calculation of the mean project cost outcomes per period of the SCIRT program, it is evident that the program performed differently throughout the duration of the rebuild (See table 3). During the transition stage the program performed well financially with an average 1.6% cost savings. There were still many small emergency repair projects, of which the design and TOC development were not well informed but once the designs of these smaller projects were completed, the design of larger projects started.

In the following ramp-up period there was an average cost overrun of 12%. During this period the average project, across all delivery teams suffered significant cost overruns against the TOC. At this time there was pressure to demonstrate progress and give the people of Christchurch confidence in the rebuild. This meant that projects during this period were designed and priced with a less than optimal constructability input. This lead to situations where some designs were at risk of being incomplete and the independent TOC development was often uninformed as to the correct methodology and associated risks. This ramp-up period also saw a significant increase in project size which occurred during a time when the SCIRT business systems and reporting structures was still being developed (See table 2 for average ramp-up period project size).

TABLE 3 Estimated project costs outcomes per period of the program

Program Period	Number of Projects	Mean Cost Overrun	Std. Deviation In Cost Overrun	95% Confidence Interval	
				Lower Bound	Upper Bound
Transition	*55*	*(1.6%)*	*4.8%*	*-11.1%*	*7.6%*
Ramp-up	*94*	*12.0%*	*3.7%*	*4.7%*	*19.2%*
Steady-state	*139*	*0.9%*	*3.0%*	*-5.1%*	*6.8%*

Due to the pressure of constructing the increased volume of work during the ramp-up, the delivery teams had to increase their workforce which led to bringing in staff that were inexperienced staff (*1*) concerning the concept of alliance contracting. The large difference between the upper and lower bound of the mean cost overruns is indicative of the big variance in the performance of the individual projects.

In the steady state period, the program showed a significant improvement in the financial performance against TOC with a cost overrun of 0.9%.

Cost Outcomes of Projects Depending on Submittance of ECI Deliverables

ECI during the transition period was interactive and informal, which was as a result of the designs being developed during the IRMO arrangement. The design of these projects were completed during a period where the designers were reporting directly to the construction company. When these projects were transferred to the SCIRT program for estimating and construction, there was no requirement from the IST to submit the ECI deliverables before the estimate could be completed.

During the ramp-up some projects had started construction before the design and TOC were completed. Very little effort from the delivery teams was put into properly informing the design and the TOC estimate as they were under pressure to start constructing the projects. There was also no requirement during the ramp-up to get the deliverables submitted prior to the TOC being signed off, nor was there any communication with the estimator. Towards the end of the ramp-up period the ECI guidelines were released and the IST instructed that no construction activity was to start before the TOC had been finalized.

During the steady state period the TOCs were not allowed to be released prior to the deliverables being submitted and any differences with regards to the methodology had been resolved. However, at the start of the steady state there were some projects that were already being estimated that had not received the deliverables on time.

The mean cost overruns for projects grouped according to submittance of ECI deliverables were analyzed per period in the program to date (shown in table 4). For this analysis the date the deliverables were uploaded to the SCIRT document control system was compared relative to the date the TOC was signed off and released. From an estimating perspective, submitting the deliverables late has the same result as not submitting the deliverables at all. Either they are taken into account in the estimate or they are not. From a project perspective, if the deliverables are submitted late this indicates that pre-planning of construction has been undertaken for the project.

TABLE 4 Estimated mean cost overruns relative to TOC of projects grouped by input of ECI deliverables.

Program period	ECI Deliverables	Number of Projects	Mean % Cost overrun	Std. Error Mean Cost overrun	95% Confidence Interval	
					Lower Bound	Upper Bound
Transition	Not Submitted[1]	*51*	*0.2%*	*4.6%*	*(9.0%)*	*9.4%*
	Deliverables late[2]	*4*	*(24.8%)*	*16.4%*	*(57.7%)*	*8.1%*
Ramp-up	Not Submitted	*59*	*14.3%*	*6.5%*	*1.5%*	*27.1%*
	Deliverables late	*27*	*10.4%*	*9.5%*	*(8.5%)*	*29.4%*
	Deliverables on time[3]	*8*	*(0.1%)*	*17.5%*	*(34.9%)*	*34.7%*
Steady state	Not Submitted	*21*	*4.1%*	*4.9%*	*(5.5%)*	*13.8%*
	Deliverables late	*57*	*2.6%*	*3.0%*	*(3.3%)*	*8.4%*
	Deliverables on time	*61*	*(0.3%)*	*2.9%*	*(5.9%)*	*5.4%*

The 4 projects in the transition period with deliverables that were submitted late show an average (24.8%) overrun, or 28.4% cost saving, however the small sample size causes the standard error of the mean of 16.4% is large. Considering the upper of 8.1% and lower bound of (57.7%) for these projects it can be argued that pre-construction planning made a positive difference in the performance of these projects.

During the ramp-up, projects that have had no deliverables submitted had the biggest average cost overrun in the program of 14.3%, while projects during the same period that did have deliverables submitted on time has an average saving of 0.1%. This shows that there is an improvement of 14.4% against TOC of projects that have had deliverables submitted on time during the ramp-up period. During the same period there is a 3.9% improvement of performance against TOC for projects in the ramp-up that have had deliverables submitted late and therefore have had the benefit of pre-construction planning, but did of which the TOC estimation was not informed.

Projects in the steady state that have had deliverables submitted on time are performing similar to the projects in the transition period with no formal deliverables submitted. The projects in the steady state that have had deliverables submitted late or not at all are performing slightly worse than the projects in the steady state with deliverables submitted but better than the projects in the ramp-up.

The combined estimated marginal mean cost overrun of projects that have not had deliverables submitted or submitted late for TOC sign off during the steady state period is 3.0% while the projects in the same period that have had deliverables submitted have an estimated marginal mean gain of (0.30%) which indicates that there is a 3.3% improvement in performance against TOC on projects where the estimate and design is well informed.

CONCLUSIONS

The SCIRT Alliance model was developed for all parties to work collaboratively to optimize the design solution through reducing risk by having access to Early Contractor Involvement into the design of a project. ECI not only provides constructability input into the design, but also significantly informs the TOC estimate of each project and therefore gives the client organization price certainty of the cost of the work. If the program is broken into three distinct periods, it is evident that with ECI input into the design and TOC development the projects are performing better financially and providing the client organizations with more price certainty. The three periods in the recovery period, the transition, ramp-up and steady state each had a different ECI input.

The difference in cost performance of projects between the transition stage and the ramp-up is 10.4% while the difference between the ramp-up and steady state is 11.1%, with an average of 10.7% financial improvement of projects with ECI input during design and price development. The financial performance of projects during the ramp-up phase is significantly worse that the two other periods and was caused by the high pressure to get on with the work.

In the final period, the combined estimated marginal mean cost overruns of projects that have not had deliverables submitted or submitted too late 3.0% while the projects in the same period that have had deliverables submitted on time have an estimated marginal mean cost saving or underrun 0.3%. This indicates that there is a 3.3% improvement in financial performance on projects that have had ECI.

By preparing the ECI deliverables that are required for developing the TOC the delivery team, by definition, is undertaking a substantial component of the pre-construction planning of a project. This is evident from the result of projects that have had deliverables submitted late for the TOC development still perform better than projects that have had no deliverables submitted at all.

ECI, whether informal and interactive or formal and documented, provides price certainty to client organizations by providing construction input during the design by identifying the construction risks. Good procurement practices and project management techniques is still required for the successful outcome of construction projects as ECI input into the design and price development is not a guarantee for the financial performance of a project.

In present research the only variable that was consistently controlled for when the projects were divided into comparison groups was ECI, all other factors were randomly distributed. However the individual effects of the other contributing factors such as procurement of subcontractors, experience of staff, or risk events that may have occurred on site did affect the financial outcomes of individual projects. It is evident from the large differences in the individual financial outcomes that these factors deserve attention in the future reserach.

REFERENCES

1. Chang, Y. and Wilkinson, S. Managing resources in disaster recovery projects. In *Engineering, Construction and Architectural Management, Vol. 19(5)*, 2012, pp.557-580.
2. Koria, M. Managing for innovation in large and complex recovery programmes: tsunami lessons from Sri Lanka. In *International Journal of Project Management, vol. 27(2)*, 2009 pp. 123-130.
3. Office of the Auditor-General, November 2012
4. Eriksson, P.E. Partnering: what is it, when should it be used, and how it should be implemented? In *Construction Management and Economics, Vol. 28(9)*, 2010, pp. 905-917.
5. Bresnen, M. and Marshall, N. The engineering or evolution of cooperation? A tale of two partnering projects. *International Journal of Project Management*, 2002, 20(7), pp. 497–505.
6. Fisher, N. and Green, S. 2001. Partnering and the UK construction industry the first ten years - A review of the literature. *Modernising construction*, National Audit Office, London, pp. 58–66.
7. Green, S. D. Partnering: The propaganda of corporatism? ASCE, *Journal of Construction Procurement*, 1999, 5(2). pp. 177-186.
8. Li, H., Cheng, E. W. L., and Love, P. E. D. Partnering research in construction. *Engineering, Construction and Architectural Management*, 2000, 71, pp. 76–92.
9. Loraine, R. K. Project specific partnering. *Engineering, Construction and Architectural Management*, 1994, 11, 5–16.
10. Naoum, S. An overview into the concept of partnering. *International journal of Project Management*, 2003, 211, 71–76.
11. Uher, T. E. Partnering performance in Australia. ASCE, *Journal of Construction Procurement*, 1999, 52, 163–176.
12. Chen, G., Zhang, G., Xie, Y.-M., and Jin, X.-H. Overview of alliancing research and practice in the construction industry. In *Architectural Engineering and Design Management, Vol. 8(2)*, 2012, pp. 103-119.
13. Scheepbouwer, E. and Gransberg, D.D. *Comparative analysis of New Zealand alliance contracting and US project delivery models*. TRB conference 2014.
14. Department of Treasury and Finance, *Project Alliancing Practitioners' Guide*. 2006. Melbourne, Australia.
15. Ekaterina, O. and Eriksson, P.E. How procurement options influence risk management in construction projects. In *Construction Management and Economics, Vol. 29(11)*, 2011, pp. 1149-1158.
16. Gransberg, D.D. Early Contractor Design Involvement to Expedite Delivery of Emergency Highway Projects. In *Transportation Research Record: Journal of the Transportation Research Board. Vol. 2347*, 2013, pp. 19-26.
17. Construction Industry Institute (CII). *In Search of Partnering Excellence, Special Publication, Vol. 17(1)*, Partnering Task Force of CII, Austin, Texas, 1991.
18. Latham, M. *Constructing the Team*, HMSO, London, UK, 1994.
19. Chan, D.W.M., Chan, A.P.C., Lam, P.T.I. and Wong, J.M.W. Identifying the critical success factors for target cost contracts in the construction industry. In *Journal of Facilities Management, Vol. 8(3)*, 2010, pp.179-201.
20. Davis, P. and Love, P. Alliance contracting: adding value through relationship development. In *Engineering, Construction and Architectural Management, Vol. 18(5)*, 2011, pp. 444-461.
21. Chan, J.H.L., Chan, A.P.C. and Lam, P.T.I. Risk mitigation strategies for guaranteed maximum price and target cost contracts in construction. In *Journal of Facilities Management, Vol. 10(1)*, 2012, pp. 6-25.