

Achieving Project Outcomes for Construction Frameworks

Terence Y M Lam
Faculty of Science & Technology
Technological and Higher Education Institute of Hong Kong
terencelam@vtc.edu.hk

Keith S Gale
Department of Engineering and the Built Environment
Anglia Ruskin University
Keith.gale@hants.gov.hk

Abstract

The collaborative construction frameworks have been developed as an innovative procurement in the major countries such as the UK and South Africa to create longer term relationships between clients and contractors to improve project outcomes. Previous research undertaken into highways maintenance projects set within a major county council in the UK has confirmed that such collaborative relational procurement methods can improve time, cost and quality of construction projects. To ensure that the expected project outcomes can be achieved, further research is conducted into the same significant case to develop a contractor performance model through identification of performance drivers at the procurement and construction phases. Factor analysis and central tendency statistics from 100 questionnaires and content analysis using node values from 10 interview transcripts confirmed that long-term relationships, financial and non-financial incentives and stronger communication were the sociological behaviour factors driving performance. The interviews also established that key performance indicators (KPIs) can be used as an operational measure to improve performance. Applying the sociological and operational constructs of the performance model, client project managers can effectively collaboratively drive the performance of construction frameworks to achieve project outcomes. Further research should be conducted on building projects so that the model can be further tested and become more robust. This research can also be expanded to other countries to confirm its applicability in international settings.

Keywords

Construction frameworks, Project outcomes, Performance model, Procurement and construction phases

1. Introduction

The importance of the construction industry and its influence upon the overall economy of the UK is specifically mentioned within the *Government Construction Strategy* (Cabinet Office, 2011). The need to improve project performance is reinforced by providing a holistic vision of the industry through the

Industrial Strategy: government and industry in partnership, Construction 2025 (Department for Business, Innovation and Skills, 2013) by encouraging development and growth of UK construction within overseas markets whilst providing challenging targets for domestic consumption. Such performance improvement suggested a 33% reduction in the initial cost of construction and the whole life cost of built assets based on 2009/2010 benchmarks, supported by a 50% reduction in overall time, from inception to completion, for new build and refurbishment assets based upon the UK industry performance in 2013. In England, highways maintenance represents approximately 50% (£2.35b in 2009/10) of the total government spending on highways services (Audit Commission, 2011). Department for Transport (2013) anticipates a cost saving of 30% or more from highways maintenance by 2020. Achievement

of the efficiency targets requires a significant change from traditional procurement methods and in the way how construction projects are managed.

Public sector frameworks were developed under EU Directive 2004/18/EC of the European Parliament for coordination of procedures for the award of public works contracts, public supply contracts and public service contracts. A prime objective of a framework is to provide stronger relationships through longer term arrangements using engagement with fewer contractors (Construction Excellence, 2009), providing alignment with initiatives suggested by Latham (1994) and Egan (1998). A framework agreement provides an overarching ‘umbrella’ contract where projects separated into individual ‘work packages’ procured at a call-off stage throughout the period of agreement. With public sector agreements, Public Contracts Regulations 2006, and EU Directive 2004/18/EC of the European Parliament of the Council of 31 March 2004 dictates that the maximum term of a framework agreement shall be four years in duration, unless strong exceptions can be demonstrated. The framework agreement is written to allow for a wide range of project characteristics and values as detailed specifications of individual projects are often not well defined at the outset date of the agreement. The majority of framework arrangements are between a client (or conjoined clients) and multiple suppliers.

Research into project performance outcomes (quality, time and cost parameters) of collaborative construction frameworks in terms of what and how improvement can be achieved is limited (Meng, 2012). A recent empirical work established, through a localised regional UK public sector case study, that significant improvements are possible in quality (lower defects upon completion and higher health and safety standards during construction), time (substantial number of projects finished on time) and cost (significant number of interim payments agreed within 5% of value and hence minimum claims) for highways maintenance projects through the use of framework agreements (Lam and Gale, 2014). It was suggested further research should be conducted to investigate the causation of such performance improvement, although construction frameworks are currently adopted as an innovative procurement in major countries like the UK and South Africa. Other research also suggests that the influence of chosen procurement and engagement method together with conditions of contract may have impact on project outcomes (Forgues and Koskerla, 2008; Koskinen, 2009). Existing research primarily focuses on project outcomes rather than performance influences. This research aims to build upon published studies to develop a performance model for managing construction frameworks to achieve project outcomes through identification of performance drivers at procurement and construction phases, using empirical evidence from highway maintenance projects.

2. Organisational behaviour drivers initiated at the procurement phase

The link between organisational culture and productivity/performance is well established, being supported by a substantial number of studies from the field of socio-psychological investigation into teams and groups. Recent research places a progressive stratification of interaction between group culture, group behaviour and group performance. Tellis *et al.*, (2009) concluded that culture drives behaviour for groups at a cognitive level using standard procedures following Zhang and Liu’s (2006) ‘culture – effectiveness’ model where culture provides motivated behaviour in order to increase performance with Chinese contractors. In light of such studies Walker (2011) warned ‘research on the impact of culture on organizational performance is mixed’ and although cited examples from a range across the cultural spectrum, no definitive conclusions were reached. Nonetheless, a review of the published literature places behaviours as a driver for group performance and in reflection of this organisational behaviour forms the sociological drivers for performance.

A literature review of collaborative centric performance based groups identified characteristics that contributed positive results in outcomes with construction projects (Katzenbach, 2000). Ten significant characteristics identified by Katzenbach were reaffirmed by Akdemir, *et al.*, (2010) who ranked 26 characteristics into the most effective ten behaviours. The ten behaviours are collated in Table 1 and supported by other discrete research references. Traditional behaviour theory directly linked performance to financial payment (Taylor, 1914) where human production is proportional against pecuniary gain. Mayo (1949) and Dennison (1925) held similar views by recognising significant influences on groups caused through long term relationships and the fear of unemployment. It was proposed that removing the fear of unpredictable employment allowed the utilisation of affirmative forces of pride (satisfaction), team spirit and loyalty (relationships), and emulation (group motivation and incentives) (Dennison, 1925). This was reinforced by further studies (Dennison, 1931) where influence

upon output performance required an intrinsic mix of non-financial incentives, satisfaction, motivation and economic incentive. Proviso to Dennison's conclusions was the essential presence of a long term strong relationship between group members. Traditional group behaviours of motivation, satisfaction, relationship and incentives suggested by Mayo and Dennison are explored by more recent contemporary behaviour research topics of motivation, trust, culture and power (Walker, 2011).

Table 1: Ten most significant group behaviours

Behaviour	Emphasis	Literature source reference
Communication	Improved communication enables groups to raise performance level	Greenberg and Baron (2003)
Trust and confidence	Distribution of fairness with group participants	Culyer (2001)
Empowerment	Decision making process delegated to individuals	Green (2002)
Effective incentive system	Non- financial and financial reward methods	Eriksen (2001)
Diversity	Mixture of group participants and geographic locations	Milakovich and Gordon (2001)
Motivation	Practice of providing purpose and direction to behaviour	Greenberg and Baron (2003)
Knowledge transfer	Tacit knowledge shared between group participants	Keskin (2005)
Relationships	Breaking down barriers and focussing upon group rather than individual outcomes	McCann (2004)
Satisfaction	Achievement of group goal setting	Fischman, <i>et al.</i> (2004)
Decision making	Critical thinking and conflict resolution skills required for ethical decision making	Fischman, <i>et al.</i> (2004)

3. Operational contract measures used at the construction phase

Within the construction industry additional monetary payments to encourage increased output set against out-turn productivity targets has historically been a popular method of incentive. Studies concerning use of incentive methods for operatives (trades people) confirmed financial benefits to contractors – those operating bonus schemes for operatives achieved higher levels of productivity per unit cost when compared with those contractors that did not (Reiners and Broughton, 1953). Other incentive mechanisms rather than direct proportional financial payment have also been investigated. Fleming (1967) concluded that productivity improvement in house building projects could be achieved by use of contract procedures that matched supplier capability rather than overstretching the sub-contract supply chain. An amalgamation of incentive mechanisms at overall construction management level was suggested by Bresnen and Marshall (2000) who proposed that financial incentives coupled with advanced contracting methods could improve both commitment and motivation within projects. Although financial incentives predominate, incentivisation between and within organisations may also operate at a socio-psychological level. The use of collaborative working, such as within framework agreements, often involves commitment from suppliers throughout the supply chain without reciprocal guarantees of work from clients (Hughes *et al.*, 2006) – and yet these arrangements encourage strong motivation through continued relationships.

Within the fields of generalised sector non-specific project management a wide variety of measures are used to describe outcomes of a project and input characteristics that affect outcomes (Banker *et al.*, 1984). Traditionally research into success with construction projects has focussed upon three outcomes – cost, quality and time (Belassi and Tukel, 1996). As projects have become more complex and clients demand more sophisticated, additional outcomes that add value such as long term sustainable development, environmental impact and reliability with use are placed to the fore (Chan and Chan, 2004; Harty 2008). The construction industry, through innovation and success with complex headline projects (Olympic Village London 2012, Heathrow Terminal 5 and the like) has received interest from academics and practitioners regarding the change in perception from what was hitherto considered a ‘low tech’ sector.

In reflection of the research into critical success factors a constructive approach is taken from measures undertaken to identify a clients’ perception of success. Kerzner (2001) reconfirmed previous studies of a client’s ‘iron triangle’ of cost quality and time as critical success factors of project success. The case study used for this research used additional critical success factors’ reflecting the connection between a safe work environment and productivity (health, safety and welfare provisions) but essence of the performance model is focussed toward the holistic operation rather than individual factors. To this end the interaction of performance outcomes and reward systems is considered the driver of good performance. This view is supported through studies conducted by Tang *et al.*, (2006) which recognised the correlation between

direct collaborative tools and collaborative project success. Such operational models are also identified through cooperative procurement in Sweden (Pesamaa, 2009) where performance is rewarded through incentivised mechanisms.

Five critical success factors were used within the case study to as operational metrics to measure project outcomes. The framework contractors received marks according to the criteria and measures identified in Table 2.

Table 2: Operational metric critical success factors as project outcomes

Critical Success Factor	Element	Measure	Metric
CSF1A	Starting on time	Time scale	Proportional - 100 for starting on the contractual date and a sliding scale where started late
CSF1B	Finishing on time	Time scale	Proportional - 100 for finishing on the contractual date and a sliding scale where finished late
CSF2	Accuracy of payments	Cost	Proportional - 100 for a payment submitted within 5% of certified value and then on a sliding scale where payment values are different
CSF3	Right first time	Quality	Projects completed without defects – binary result – yes 100, no 0
CSF4	Health, safety and welfare inspections	Quality	Proportional – percentage of inspections meeting minimum criteria

The reward system placed within the operational construct of the performance model consisted of a graded composite aggregation from results. Depending upon aggregated values, contractors are placed into one of three zones – red (0-24), amber (25-75) or green (76-100). The zone positions are used for tender assessment purposes for a succeeding three month period where a green zone supplier will gain a 10% advantage in tender assessment score (10% reduction adjustment on the tender bid), an amber zone supplier receives neutral tender assessment (no adjustment on the tender bid) and a red zone supplier has a 10% disadvantage in tender assessment score (10% addition adjustment on the tender bid). The lowest adjusted tender bid will win the contract, although the submitted tender sum remains for acceptance into a contract. These results offer a financial advantage or disadvantage for each supplier according to objective and measured past performance that is be used in the selection of suppliers for future projects.

Operation of such incentive based financial systems used to facilitate project performance follow propositions made by Bayliss *et al.* (2004) and Tang *et al.* (2006). The key performance indicators (KPIs) / metrics are displayed as an operational construct within the performance model.

4. Hypothetical performance model

Based on sociological group performance theories and performance management theories, a performance management model is proposed in Figure 1, comprising a **sociological construct** developed from group performance theories consisting of ten identified behaviours placed in a construction industry context, and an **operational construct** developed from performance management theories related toward measurement and operation of KPIs which are linked to reward systems.

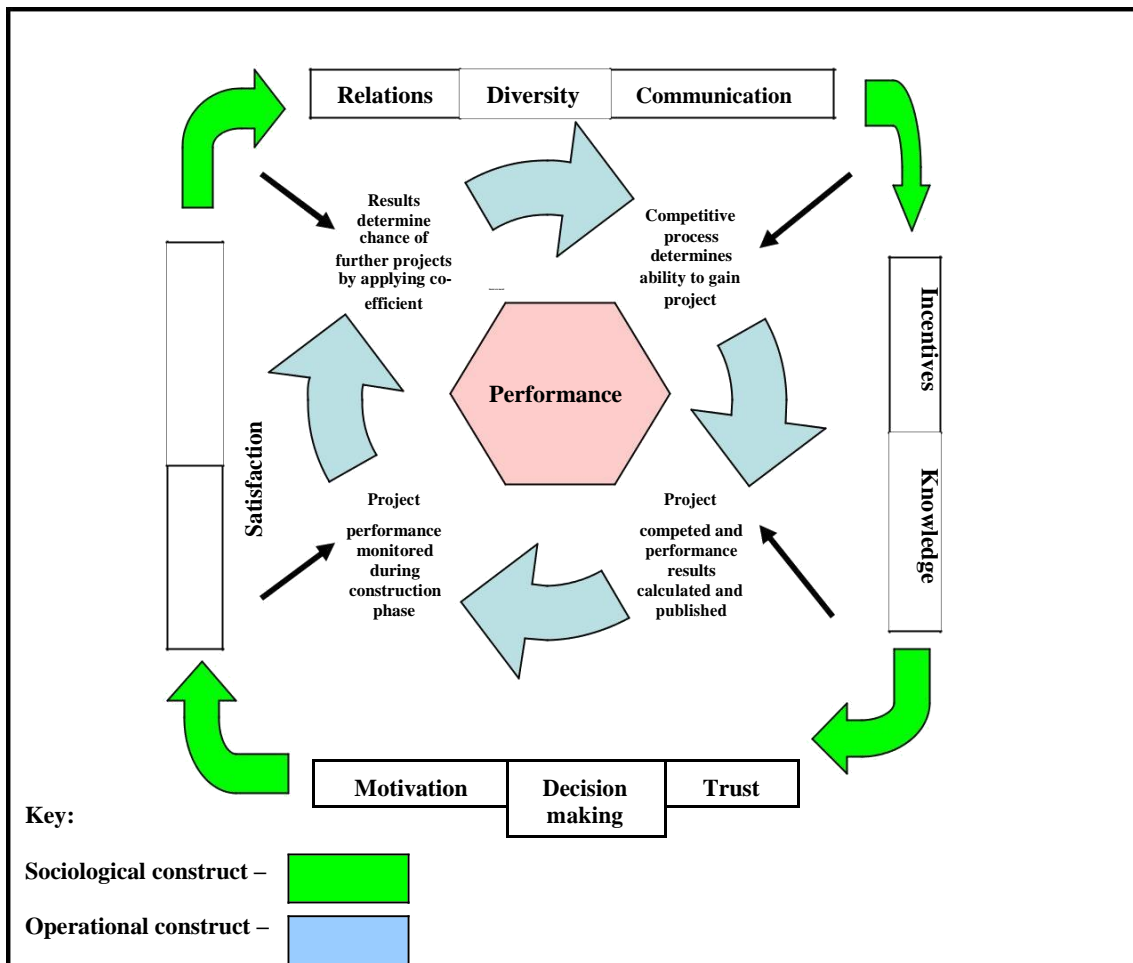


Figure 1: Hypothetical Performance Model for Construction Frameworks

5. Research methods

This research is set within a paradigm of a ‘single case study’ in order to explore data and information relevant for a public sector organisation. In construction management disciplines case studies can provide data of highest quality and depth (Wineburg, 1997). The chosen organisation is a major county council with sufficient economic mass (> £1Bn annual turnover) and also has a continuous requirement for construction industry products in delivery of its statutory duties. The organisation also directly employs more than 100 qualified staff, such as engineers and quantity surveyors, with the management of projects allowing access to views from practitioners allied to the construction professions. Within the case study, the following source data is available:

A pilot study with 20 practitioners to gauge initial results through *a priori* investigation and ascertain if the sociological construct arrived from examination of published literature provided a basis for further enquiry.

A quantitative questionnaire survey conducted with 100 practitioners (out of an estimated population of 180; 55.6% sample size) from public sector employees and private sector framework contractors. These are very high results that meet the ‘rule of thumb technique’ suggested by Neuman (1994) of 30% minimum sample size for populations under 1000.

In-depth semi-structured interviews with 10 practitioners (5.6% sample size) experienced in both framework and traditional discrete projects. Mintzberg (1979) points out that ‘*we uncover all kinds of relationships in our hard data, but it is only through the use of this soft data that we are able to explain them*’.

Factor analysis and central tendency statistics from the ‘questionnaires’ and qualitative content analysis using node values from the ‘interview transcripts’ to validate and

explain sociological behaviour factors and operational performance measures.

Use of quantitative and qualitative approaches in tandem to test the sociological and operational constructs of the proposed performance model can provide objectivity, generalisation and authenticity to the research (Raftery *et al.*, 1998).

□ Findings and discussion

6.1 Pilot study results

The operational construct using metrics and performance zone was operated for a 24 month period (8 consecutive 3 month performance periods) to gather project success index results and establish the incentive mechanism. During this period the significant group behaviour factors were subjected to a pilot study involving 20 participants. Confidence with results from the pilot study confirmed recognition of the same ten behaviours identified from research into characteristics of high performance organisations (Akdemir *et al.*, 2010). This pilot study with participants also identified four group behaviours as the most effective performance drivers, placed in order of preference of participants are relationships (15), satisfaction (13), incentives (12) and motivation (11). The results allowed construction of a research questionnaire for issue to case study participants.

6.2 Questionnaire survey: central tendency statistics

As a conformational check to the factor analysis, the ten behaviour characteristics tested through responses from participants were subjected to a measure of central tendency using a mean score. For this check, responses were assigned a ranking against participant responses for a Likert (1932) scale between 1 and 5 to the manipulated values in Table 3.

Table 3: Measure of central tendency for the ten behaviours

Predominant sociological behaviour factor	Mean Score	Rank
Relationships (long term)	3.92	1
Communication	3.49	2
Decision making	3.25	7
Knowledge transfer	3.25	7
Incentives	3.30	4
Trust	3.35	3
Empowerment	2.31	10
Diversity	3.21	9
Satisfaction	3.26	6
Motivation	3.30	4

The central tendency results provide an indication of the most significant group behaviour characteristics with which to explore in greater detail. Participants do indicate that relationships are of prime importance with successive ordered ranking on communication, trust, motivation and incentives. Although measures of central tendency represent an approximate method of analysis, further examination through factor analysis was used to identify the underlying trends.

6.3 Questionnaire survey: factor analysis results

Responses from participants to questions regarding ten behaviours for successful group performance included within the questionnaire were subject to an examination of suitability for factor analysis. Inspection of the correlation matrix revealed a significant number of coefficients above 0.3 (68 out of 100). The KMO value was 0.861 and Bartlett's test reached statistical significance supporting use of data for factor analysis. Eigenvalues exceeded 1 for two components, explaining 42.7% and 10.5% of the variance respectively. An inspection of the scree plot revealed a break after the second component.

To aid with interpretation of the two components, Varimax rotation was performed and showed

six strong loadings with three cross loadings. The strongest values loaded substantially on one component

in which incentive, decision making, relationships, trust, knowledge transfer and motivation have a factor loading of greater than 0.6. The two component solution explained a total of 53.2% of the variance, with component 1 contributing 33.9% and component 2 contributing 19.2%.

6.4 Qualitative interviews: content analysis results

Qualitative methods selected for analysis of interview transcripts comprised word frequency, node theme classification and meta-synthesis in order to elicit individual participant statements and these are aggregated into group views. Interpolation of the aggregated group views are designed to represent predominant views of the sociological group class provided that saturation has occurred (Guest *et al.*, 2006). Aggregated coding results synthesised into a structured node tree displayed commonality with clusters allowing group views to be summarised. The thematic meta-synthesis analysis was used to uncover an interrelated number of key results (or themes) that can be placed according to frequency into a hierarchal structure. Aggregation of results allows strength of a theme to be measured within the sociological group, where higher values represent stronger affirmation to that theme. The most significant theme concerned relationships, where successful ones improve performance and is operated through incentives (either financial or psychological). The performance node also includes operation of KPIs as part of performance measures. A sub-node to relationships is communication – where aggregated responses had values in excess of 50 for operational factors with contracts (measurement process) and frameworks (performance process). Sociological behaviour was recognised as being more effective than financial rewards as suggested by Thibaut and Kelly (1959) in *The Social Psychology of Groups* and expanded through a general independence theory by Rusbult, *et al.* (1998). The case study interview results align with this published research as participants recognise satisfaction of sociological needs and rewards more readily through framework arrangements when contrasted with discrete methods.

During interviews with selected participants a number of themes emerged and were recognised as interrelated. The following is a summary of practitioners own views, which confirm the significant sociological and operational factors and explain how they drive project outcomes within the framework project organisation.

{Sociological factors} ...encourage a stronger and a closer relationship because you are participating together and as a result you create more common goals and have a key working approach

{Sociological factors afford} ...better communication and that's more likely to happen in a framework because of the strong relationships

{Operational factors} ...are rewarded with incentives from performance and they are benefiting from that

{Operational factors} ...enable both sides to look at historical performance data related to the project to identify where the client team and the contractor team members need to improve.

Reflective analysis of the model indicates a strong association of performance with each significant element. The operational construct relied upon use of KPIs to measure project outcomes where successful projects could place suppliers for selection of a future project by use of a marginal incentive system related to price and quality assessment. Operation of the construct gave a measurable improvement in project performance outcomes on the projects contained in the case study and this investigation formed a separate research paper (Lam and Gale, 2014). The operational construct of the performance model operates in the manner proposed and in the sequence anticipated. In partial explanation and allied to the Hawthorne studies (Mayo, 1949) the process of measurement and desire to compete appears to provide a strong driver to performance improvement. As participants state:

‘...the fact that our performance is being monitored and that monitoring of our performance contributes to our future ability, or not, to secure more work, ...raises the priority to make the customer that bit more important..’.

‘... if you're going to be measured on something it becomes a greater priority for you’.

‘... in the public eye with performance data being published ... they will stick to something ..’. Within the generalised view, individual components – described by practitioners through their own words in response to interview questions – provided a significant awareness of the drivers of performance. The extent of this is perhaps surprising given the traditional conservative views of the construction industry (Davies, 2008) and realisation that case study participants had less than three years experience of framework agreements at the time of interview. Coupled with a natural resistance to organisational change proposed by Smollen (2011), the strength of results and engagement of participants with drivers of performance is somewhat significant.

6.5 Summation of qualitative and quantitative data

Analysis from factor analysis results provided a significant component with high factor loadings for incentives, decision making, relationships, trust and knowledge transfer. The factor, labelled duration, required a continuance of passage of time with which to gain performance outcomes. A measure of central tendency found three behaviours (relationships, trust and incentive) that aligned with strong factor loadings. Nodal aggregated values taken from interviews provide that relationships, communication and incentives are the most repeated themes. The combination of questionnaire and factor analyses (quantitative evaluation) and interview analysis (nodal aggregation) provides a comprehensive and compelling view of group views which confirm that relationships, communications and incentives as key components of sociological group themes. All the results are summarised in Table 4.

Table 4: Summation of significant behaviour results

Loaded factors from factor analysis	Rotated component value	Central tendency from questionnaire	Mean value	Significant qualitative nodes from interviews	Node aggregate value
Relationships	.725	Relationships Communication Trust	3.92 3.49 3.35	Relationships Communication	174.56 46.99
Incentives	.778	Incentives Motivation	3.30 3.30	Incentives	58.15
Decision making	.772				
Trust	.636				
Knowledge transfer	.608				

7. Construction of performance model

The tripartite data collection – pilot, questionnaire and interview – where results align provides confidence to conclusions made with the performance model, as shown at Figure 2.

Completion of the analytical phase of the research allows reevaluation of performance model. Following an initial pilot placement of components, two constructs were prevalent. Construct one consisted of the operation of incentives through collection of project data being compiled into performance zones and forming incentivised drivers to encourage and maintain project performance levels. In the model construct one is labelled the operational construct. The influence of organisational group behaviour upon performance outcomes through integration of views from a class of technical professions is represented through construct two and this is labelled sociological construct.

Data analysis collated for the final model provided confirmation that the original constructs of the proposed model remained unchanged. At the centre of both models, performance and the desire to improve remained constant. Examination of each construct is undertaken to identify changes in the elemental components which appear in the construct. For the sociological construct, the proposed model identified incentives, motivation, satisfaction and relationships as prime behavioural components arising from a pilot study. Prime behavioural components for the final model following factor analysis, central tendency and qualitative node aggregation placed relationships, incentives and communication at the fore. The predominant underlying factor for the sociological construct was duration. Obviously longer duration of framework allows stronger relationships and communication to be developed between participants as well as more non-financial and financial incentives to be gained by contractors.

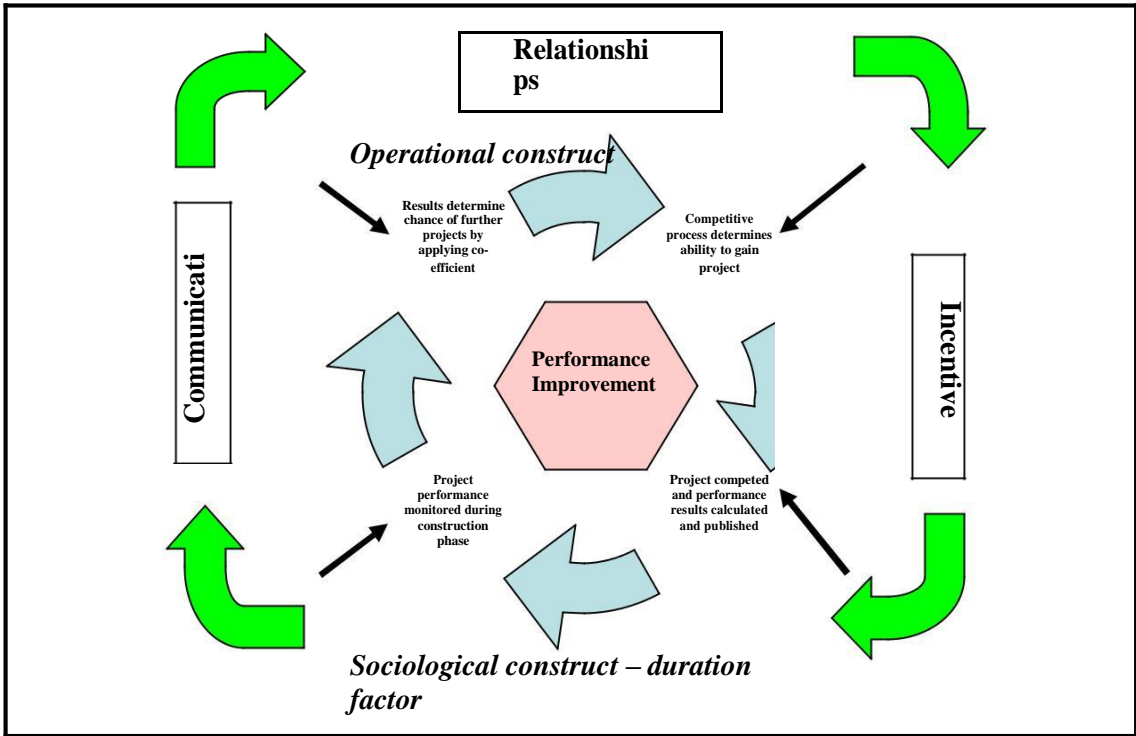


Figure 2: Validated Performance Model for Construction Frameworks

8. Conclusions

The purpose of this research was to develop a contractor performance model for construction frameworks in order to achieve the expected project outcomes. The proposed model comprised a sociological construct developed from group performance theories consisting of ten identified behaviours, and an operational construct developed from performance management theories related toward measurement and operation of KPIs which are linked to reward systems. Such model focused on the impact of performance drivers initiated at procurement and construction phases upon contractor performance. Synthesis of results identified three significant behaviours – relationships, incentives and communication, set within a factor of duration. The underlying factor of duration reflects long term arrangements of framework agreements and allows development of the three significant behaviours. Reflection of the performance model through interviews confirms that operational methods and organisational behaviours drive performance in construction framework projects. Practically client project managers can apply the sociological and operational constructs of the model to effectively manage the contractor performance and drive the project outcomes for construction framework projects.

The case study projects are set predominantly in the field of highways maintenance. This has allowed detailed comparison of outcomes due to containment within a specific classification, but other types of projects could be explored. It is suggested that building projects are used for further research of the phenomena discovered so that the model can be further tested and become more robust. This research can also be expanded to other countries to confirm the model's applicability in international settings.

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