Comparison of two infrastructure project implementation models in a developing country

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Abstract

A comparative analysis of public sector infrastructure projects implemented using a traditional public sector model versus projects implemented using a modern management contractor model is presented. Traditionally, the implementation of public sector construction projects in South Africa is undertaken by an implementer such as a Department of Public Works on a traditional design by employer contracting strategy. However, in 2014, the Western Cape Education Department created a framework contract and employed two management contractors with single point accountability to implement maintenance and upgrading projects alongside those implemented in the traditional manner. 122 projects implemented by management contractors are evaluated and compared with 35 implemented by the Western Cape Department of Transport and Public Works based on cost performance, time performance, and professional services costs of the two approaches. The practice of including contingency and provisional sums in contracts distorts the cost performance analysis and superficial comparisons can be misleading. The management contracts delivered more projects on time. The professional service costs associated with management contracts was 9.2% compared to 15.6% for public works projects. The overall evidence demonstrates that the management contracting system is efficient and suited to the nature of maintenance and upgrading projects and delivers significant advantages.

Keywords: contracting, procurement, project management

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1 Introduction

This paper reports on research carried out in 2016 to analyse the efficacy and professional services costs associated with two approaches to the implementation of public sector infrastructure projects in South Africa. Using projects of the Western Cape Education Department (WCED) as a case study involving the maintenance, repair and upgrading of educational facilities, the analysis of 35 projects implemented by the Western Cape Department of Transport and Public Works (WCDTPW) via a 'traditional' delivery approach whereby separate entities are contracted to provide professional services and to perform the works is compared with 122 projects implemented by management contractors with single point accountability for professional services and the performance of the works. The purpose was to evaluate and compare the performance and professional services costs of projects implemented by the WCDTPW with that of projects implemented by management contractors on WCED projects.

The paper structure is as follows:

- Background to the study
- Research aim and specific objectives
- Research design and data collection
- Analysis of management contracting projects
- Analysis of public works projects
- Comparison of management contracting and public works projects
- Conclusions and recommendations

The findings demonstrate the value of either approach as well as issues associated with using public works departments and management contractors with single point accountability. The research is useful for guiding those responsible for the implementation of infrastructure projects in making informed choices in relation to the employment of public or private sector resources to manage the implementation of infrastructure projects.

2 Background to the study

A client initiates, commissions and pays for infrastructure projects. The principal role of the client is to ensure that a solution to the business case for a project is achieved. The client as such owns the business case of the project and needs to provide effective leadership of the project throughout the project life cycle, commencing at a strategic level and ending at the close out of a project after the beneficiary of the project has accepted and operates the infrastructure that is delivered (see explained in ICE, 2009 Client Best Practice Guide).

A client needs to either have in-house resources or to procure the resources that are necessary to function as a client, to implement projects once a decision has been made to proceed with implementation and to interface with stakeholders during the delivery process. A client may, however, assign or delegate certain responsibilities to another department of state owned enterprise. Where such delegation or assignment is made, the "sponsor" and the "implementer", although being different organs of state, collectively function as the "client". Typically, the "implementer" assumes responsibility for programme management, procurement, payment of contractors and professional service providers, overseeing the administration of contracts and the provision of technical advice and inputs. Infrastructure projects in the South African public sector are commonly delivered using an implementer

such as a national or provincial department or a state owned enterprise (National Treasury, 2015).

The Western Cape is one of nine provinces in South Africa. In 2009, the Western Cape Government designated the Western Cape Department of Transport and Public Works (WCDTPW) as the preferred implementer for provincial departments. All infrastructure projects for the Western Cape Education Department (WCED) and the Western Cape Department of Health were accordingly implemented by the provincial Department of Transport and Public Works. Due to a lack of capacity on the part of WCDTPW, and increasing demand for maintenance and upgrading of schools, the WCED took the pioneering step in 2014 of appointing two management contractors to implement with single point accountability the maintenance, repair and upgrading of schools. Accordingly, WCDTPW undertook a portion of maintenance and upgrading work in schools while the remainder of the work was undertaken by the appointed management contractors. Since 2014, the two management contractors have been allocated 155 projects of which 122 have been completed as at 31 May 2016. In 2014/2015 Public works took on 50 such projects of which 35 have been completed as at 31 May 2016. The simultaneous delivery of similar projects by two different types of implementers, one private sector and the other public sector, within the same environment provided an interesting opportunity for a comparative study on the performance and costs associated with the use of the two different project implementation approaches.

There are 1457 schools spread across the Western Cape Province. The Western Cape Education Department (WCED) is responsible for maintenance and upgrading of the infrastructure of the majority of these schools. This department currently carries out such work using the WCDTPW and the two management contractors.

The two management contractors were appointed in terms of a framework agreement as described by Watermeyer (2013), having a duration of 3 years, based on the NEC3 Engineering and Construction Contract (ECC), main Option F (management contract). Under this option of the NEC3 ECC, the contractor is responsible for providing the whole of the work but only does a limited amount of work himself. The contractors is paid agreed prices for the limited work they carry out themselves and on payments due to subcontractors uplifted by a fee is (Defined Cost uplifted by the Fee) . Accordingly the contractors were insulated from the cost risk of subcontracts entered into.

The NEC3 ECC was converted into a framework contract by simply introducing a Z clause modelled along the lines of secondary option X17 (task order) contained in the NEC3 Term Services Contract. The contract data that is entered into using an NEC3 ECC can then make references to package orders that are to be issued in terms of the aforementioned Z clause. Package orders can, in this manner, be issued through the standard NEC3 ECC during the term of the contract. Accordingly, the NEC3 ECC becomes a framework contract that sets out the generic terms, conditions and works information for the ‘call offs’ over the term while the package orders contain the package-specific data and information. The ‘contract’ for a work package is therefore the package order read together with the NEC3 ECC contract that is entered into. The contract that is entered into has no value in the absence of a package order and does not commit the client to the issuing of any package orders.

Table 1: WCED budget and scheduled maintenance, repair and upgrading programme for infrastructure in schools

Period	Approx. budget for maintenance, repair and upgrading of schools (1£ ~ R17.5)	Approx. number of schools scheduled for maintenance, repair and upgrading	Approx. average expenditure per project (1£ ~ R17.5)
2012/2013	R200m	130	R2.0m
2013/2014	R200m	100	R2.5m
2014/2015	R300m	85	R3.5m
2015/2016	R300m	50	R3.5m

The projects implemented by WCDTPW are mostly based on the Joint Building Contracts Committee's (JBCC) Principal Building Agreement (design by employer with a bill of quantities) although use is also being made of the NEC3 ECC (Option B, priced contract with bill of quantities) contract on some projects. Altogether the infrastructure maintenance, repair and upgrading budget for schools in the Western Cape was approximately R300m (~£17.1m) in 2015/2016. The programme for the maintenance, repair and upgrading of schools since 2012 is presented in Table 1.

The overall WCED infrastructure budget was approximately R1.5 billion (~£86m per year – for all types of project. About 20% of the budget is allocated for the maintenance, repair and upgrading of schools. The nature of financial planning in the public sector means that infrastructure projects are delivered on a 3-year budgeting cycle. Governance legislation and requirements in the public sector also makes it imperative to ensure compliance of project implementation systems with supply chain regulations, infrastructure procurement and delivery management standards, and auditing standards. This is particularly important when implementing alternative delivery approaches.

3 Research aim

The research aim was to evaluate and compare the performance and professional services costs of projects implemented by the Western Cape Department of Transport and Public Works (WCDTPW) with that of projects implemented by two management contractors employed by the Western Cape Education Department (WCED) to implement similar projects.

4 Specific objectives

The specific objectives were to:

- Identify the rationale for adoption of the management contracting approach used for maintenance, repair and upgrading of infrastructure in schools in the Western Cape.
- Ascertain how the management contracting approach was implemented in a public sector context.
- Analyse the management contracting projects including their cost performance, time performance, and associated professional service costs.
- Analyse the WCDTPW managed projects including their cost performance, time performance, and associated professional service costs.

- Compare projects implemented by WCDTPW with those implemented by the management contractors including their resourcing requirements.
- Provide evidence based demonstration of the value of the management contracting approach.

5 Literature review

It was necessary to contextualise the study with a brief review of published literature on project performance and outcomes in the South African context; and the management contracting construction procurement system. Such contextualisation is necessary for the formulation of the statement of the research problem and discussion of findings.

Project performance and outcomes

The way that project performance is measured is outlined and discussed followed by a consideration of data on project performance in South Africa. In standard project management literature, including the Project Management Institute (2013) PMBOK Guide, three key performance measures for infrastructure projects are often stated as:

- How the project concluded in relation to the approved budget;
- How the project concluded in relation to the planned completion time; and
- How the project concluded in relation to the specified quality.

A fourth dimension often less considered is whether the project or investment represents value for money and efficiency. Achievement of the three standard measures of project management performance may not necessarily imply value for money. The measurement or demonstration of efficiency and value for money infrastructure projects is complex and requires taking a combination of factors into account including the traditional measures of project management performance. The National Treasury Standard for Infrastructure Procurement and Delivery Management (2015) defines value for money as "the optimum use of resources to achieve intended outcomes". Underlying value for money is an explicit commitment to ensure that the best results possible are obtained from the money spent, or maximum benefit is derived from the resources available. It is about striking the balance between the three "E's", namely, economy, efficiency and effectiveness, whilst being mindful of a fourth "E" – equity. Expected outcomes frame the value-for-money proposition that needs to be implemented at the point in time that a decision is taken to proceed with a project. Comparisons between projected outcomes against the actual outcomes confirm the effectiveness of the project in delivering value for money. Projects need to be executed efficiently in order to minimise time delays, scope creep and unproductive costs, and to mitigate the effects of uncertainty on objectives so as to maintain the value-for-money proposition formulated at the outset of the project. This necessitates that the implementer of an infrastructure project exercises due care and reasonableness during implementation. Failure to do so may result in substandard or unacceptable performance, which results in a gap between intended and achieved outcomes. This gap puts value for money for a project at risk (Watermeyer, 2013). This seems a more comprehensive standard for evaluating project outcomes as compared with the three traditional measures for measuring project performance.

The project management outcomes of some projects in South Africa are considered in Table 2 to ascertain the extent to which cost and time aspects of value for money are achieved in projects. The data is contained in a publication by National Treasury (2015) that provides data on cost and time performance of public sector projects implemented by the Department of Public Works in 2013/2014 (See Table 2).

Table 2: Performance of infrastructure projects managed by public works, 2013/14

	CONSTRUCTION (capital projects)				MAINTENANCE			
	Number of projects completed within the contract period		Number of projects completed within budget		Number of projects completed within the contract period		Number of projects completed within budget	
Province	Target	Actual	Target	Actual	Target	Actual	Target	Actual
Eastern Cape	65	24	65	39	60	47	60	48
Free State	5	15	5	15	4	4	4	4
Gauteng	96	111	96	115	3	3	5	5
Kwazulu-Natal	346	271	346	271	43	33	43	33
Limpopo	17	15	17	15	0	0	0	0
Mpumalanga	72	71	72	90	0	0	0	0
Northern Cape	11	9	41	20	18	58	60	107
Northwest	7	2	6	2	74	10	74	13
Western Cape	123	79	123	16	560	262	560	283
	742	578	771	588	762	417	806	493

Source: Intergovernmental Fiscal Reviews (IGFR) 2015, published by National Treasury, Available online at: http://www.treasury.gov.za/publications/igfr/2015/prov/

Table 2 shows that, for example, KwaZulu-Natal completed 271 out of 346 new construction projects (78%) on time and within budget. In the Western Cape where the fieldwork for the research reported in this paper was conducted, approximately 64% of new construction projects were completed within budget and only 13% delivered on time. For other types of projects, 47% were completed within budget and 51% on time. In general, provincial public works departments completed on time and within budget a higher percentage of their new construction projects than was the case for their other projects. A shortage of engineering and related professionals, artisan, electrical and electronics engineering technician skills were reported to be the main reason for under-performance in respect of infrastructure projects.

Management contracting

The management contracting concept based on the NEC3 family of contracts is illustrated in Figure 1. A management contract according to ISO 10845-2 is a “contract under which a contractor provides consultation during the design stage and is responsible for planning and managing all post contract activities and for the performance of the whole of the contract” (see also ISO 6702-2, 2014). ISO 6707-2 notes that in the US, the equivalent term is a management fee contract. In this type of contracting arrangements, the client is at risk for the cost of subcontracts.

As demonstrated in Figure 1, management contracting enables the client to make use of a contractor’s management skills to achieve the objectives of a project. The management contractor usually does not directly undertake construction; this is spilt into work packages and subcontracted out. The management contractor typically appoints the subcontractors and

the professional service providers who are directly and contractually responsible to the management contractor. The contractor under NEC3 ECC Option F (management contract) is permitted to be paid for work which is performed by himself on a lump sum or unit rate basis. He is paid those lump sums or quantities multiplied by rates for work done himself plus the amounts due to his subcontractors. These amounts are uplifted by a fee percentage to cover his management costs, overheads and profits. The way that the management contractor secures market related quotes from subcontractors (or works done by the management contractor himself) is an important consideration. According to the NEC3 ECC this should be competitively tendered prices or open market rates (Clause 52.1).

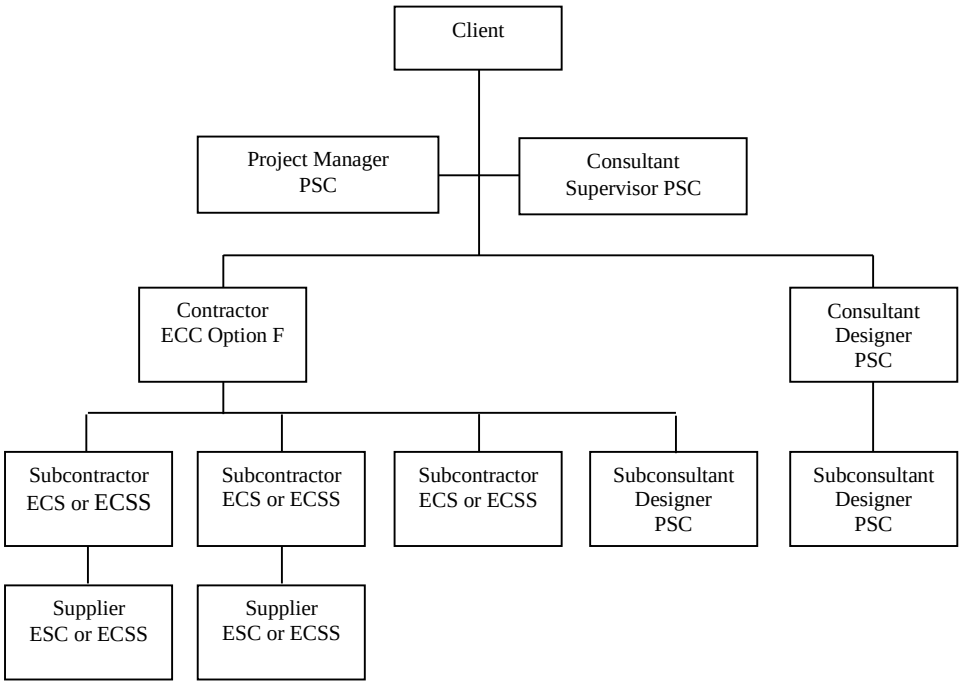


Fig 1: Typical management contracting relationships (ICE, 2013, page 9)

Legend
PSC= Professional service contract
ECS= Engineering and Construction Subcontract
ECSS= Engineering and Construction Short Subcontract

Another point relating to Figure 1 is that under the NEC3 Engineering and Construction Subcontract (ECS) or the Professional Service Contract (PSC) the Client (or Contractor) can choose between payment options for the subcontracts including activity schedules (lump sums), target contract, reimbursable contract and, additionally with the ECS, a bill of quantities option. In the case of the Contractor, this choice of option is typically required to be agreed with the ultimate Client.

Various studies including those by Naoum (1994), Ward *et al*. (1991), Naoum and Langford (1987), Sidwell (1983) and Slack and Giles (1981) describe management contracting as a system suitable for fairly large and complex projects and refurbishment projects. However,

the use of management contracting has declined in practice and there is also a decline in research literature on management contracting. Traditional management contracting went out of fashion because of certain perceived drawbacks including being conceived as having the contractor's role changed from 'poacher' to 'gamekeeper' acting on the Employer's behalf, yet still having a contractual / commercial position to defend e.g. damages on late Completion. The NEC3 Option F provides a modern context for management contracts and such contracts have been effectively used for refurbishment projects in the development of two new universities in South Africa (see http://www.newuniversities.ac.za/).

6 Problem statement and research questions

Different systems and agencies are currently used to oversee the implementation of infrastructure projects in South Africa. However, no systematic research has been done to examine the efficiency of the different approaches and the professional service costs associated with utilizing a particular approach. Without research examining the efficacy and cost implications of the different approaches, the choice of a particular approach can be quite arbitrary and subjective. In 2014, the Western Cape Education Department (WCED) appointed two management contractors to implement some of the maintenance, repair and upgrading projects in schools across the province to overcome the capacity constraints of the Western Cape Department of Transport and Public Works (WCDTPW). These management contractors and the WCDTPW perform a similar role of implementing projects for the same client. This situation where two different types of implementers are performing the same type of works provided an interesting opportunity to conduct a comparative study of project implementation in the public sector in the case where public works department and management contractors act as implementers. Two main research questions are investigated in this study.

- First: what is the nature of contractual roles and responsibilities in infrastructure projects where the WCDTPW acts as the implementer, and what are the professional services costs and outcomes associated with such projects?
- Second: what is the nature of contractual roles and responsibilities in infrastructure projects where a management contractor acts as the implementers, and what are the professional services costs and outcomes associated with such projects?

It should be noted that the WCDTPW and management contracts were put in place following a competitive tender process while the subcontracted amounts in the management contracts were either competitively tendered or open market related. As a result, the assumption was made that the cost of the works executed by the two implementers were comparable.

7 Research design and data collection

The nature of the research questions suggested that a case study would be appropriate for conducting a study that is comprehensive, intensive and inductive. It was also considered that for a comparative study of this nature, a case study can essentially help to control for factors such as location, type of work, scope of work services, and time of delivery. Both qualitative and quantitative data were required to answer the research question and a case study is appropriate for using a battery of methods to collect such data (Saunders *et al*., 2012).

The data collection phase involved gaining approval/access in April 2016. This was followed by conducting the research within WCED for one week, 23-27 May 2016, and following up in June and July 2016 for more data. The data collection involved the following activities:

- Review of project information spreadsheets. These documents provided some of the information relating to package orders, cost, time, professional fees, nature of the maintenance, repair and upgrading programmes, compensation events, location, and principal agents
- Examination of more than 50 package order files containing information about project cost, time, professional fees, and bill of quantities.
- Examination of bill of quantities / price lists to develop a clearer understanding of scope of work services and the way that the contracts were priced including the extent of use of provisional sums and contingencies
- Documentary analysis of meeting minutes containing joint evaluation of the management contracting system by client and management contractor
- Semi-structured interviews with WCED infrastructure department officials
- Unstructured interviews with representatives of the two management contractors for 90 minutes (MC1) and 75 minutes (MC2) respectively
- Content analysis of reflective anecdotal notes provided by programme managers with regards to the researcher's queries as well as grey areas, perceptions, challenges, and benefits in respect of the WCED management contractors
- Observation of photographic images illustrating before and after state of facilities.

8 Results

The research results are presented in line with the specific objectives.

Implementation of the management contracting system

It was also considered important to ascertain how the management contracting approach was implemented. Figure 2 shows the nature of contractual relationships in the management contracting system implemented in 2014.

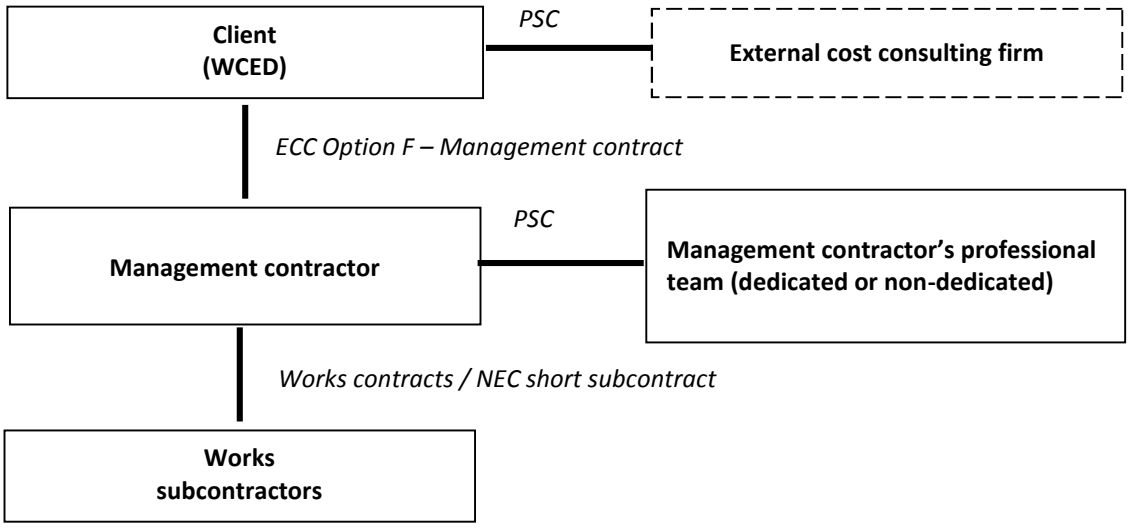


Figure 2: Contractual roles and relationships in the management contracting system

KEY

Contractual relationship

PSC – NEC Professional Services Contract
ECC- Option F – Engineering and Construction Contract, Option F – Management contract

Figure 3 indicates the delivery management framework (governance system) for the delivery of projects incorporated in the 2012 Western Cape Provincial Treasury Instructions. This framework needs to be applied irrespective of the delivery model. It was accordingly applied on all of the WCDTPW and management contracts. A project operates in an environment through a defined project life cycle. Decision gates such as those embedded in the delivery management framework indicated in Figure 3 establish the project life cycle criteria that enable the authorisation of project continuation, suspension, termination or modification. The framework indicated in Figure 3 accordingly provides the necessary governance arrangements to authorise, direct, empower, provide oversight and limit the action of management. This enables management to work within the constraints set by WCED to achieve their service delivery objectives (see ISO 21505).

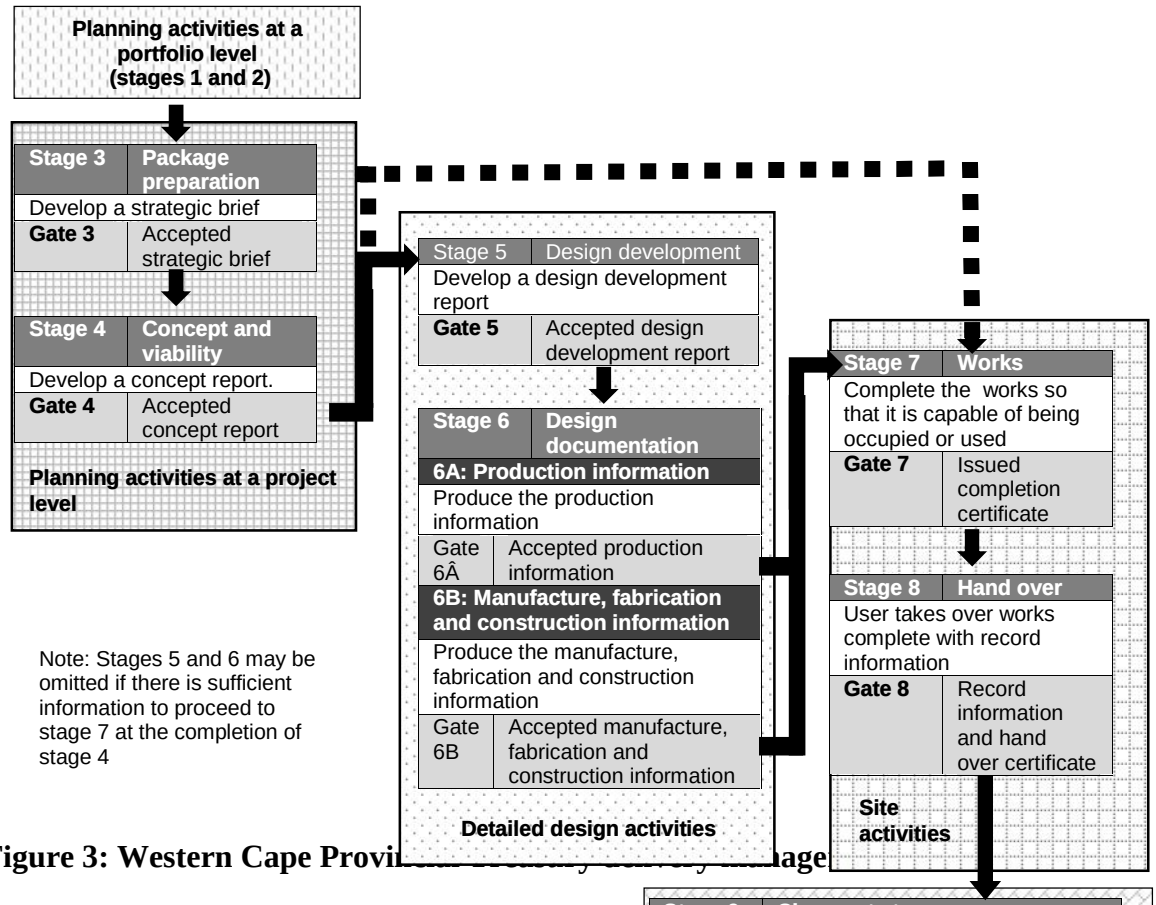


Figure 3: Western Cape Provi[illegible]age

The WCED infrastructure delivery departme[illegible]me management of the management contracting [illegible] of Infrastructure Delivery. The director oversees both[illegible]ely 80% of infrastructure budget as demonstrated i[illegible]nd upgrading projects (20% of infrastructure budget). [illegible]ne Chief Architect looking after Maintenance (scheduled and emergency) and the Management Contractors. The Management Contractor section has one Architect who deals only with MC projects and one Admin person who also processes payments for MC. The in-house quantity surveyor (QS) also assists the team and spends approximately 30% of his time on MC. An

external quantity surveying firm provides cost consultancy services for the management contracts including verifying market related quotes and certifying payment for works.

Analysis of projects implemented by management contractors

The results presented in this section cover the nature, cost analysis, time analysis and professional fees associated with the management contracting projects.

The analysis is based on 155 maintenance and upgrading projects in schools from 2014 to 2016. The 155 projects are located in more than 120 different locations/towns in the Western Cape. The total value of the 155 package orders is R255,727,049 (~£14.6m) (AVG R1.64m (~£0,09m) per contract). Two different management contractors have implemented the 155 projects. For the purpose of this paper, one of the management contractors is designated as MC1 and the other is designated as MC2. MC1 has a Construction Industry Development Board (CIDB) contractor grading designation of 9 (annual turnover at time of registration in excess of R200 m (~£11.4m) and is a multi-disciplinary construction and engineering group operating nationally and internationally. The company has over 125 years of experience and is a B-BBEE (Broad-Based Black Economic Empowerment) Level 3 contributor. MC2 has a CIDB contractor grading designation of 8 (annual turnover at time of registration in excess of R65m (~£3,7m) and is a building and civil engineering contractor with 20 years of experience. MC2 operates in three provinces and is a B-BBEE Level 5 contributor. In terms of the allocation of work, based on capacity and performance in meeting the programme requirements, MC1 has been allocated 53 package orders and MC2 has been allocated 102 package orders to date. MC1 did not do any of the work by itself, citing the nature of the contract as the main reason. They used subcontractors to execute all projects. Of the 53 contract allocations to MC1, 29 are complete and 24 are in construction. For MC2, 93 contracts are complete and 9 are in construction. MC2 did most projects by itself although they used about two local subcontractors in each project. The total value of the 53 contract allocations to MC1 is R 139,054,317 (~£7.9m) (average R2.62m (~£0.15m) per contract) and total value of the contract allocations to MC2 is R116,672,732 (~£6.66) (AVG R1.14m (~£0.07m) per contract). A framework contract of 3 years duration was first established and then two management contractors were appointed under an NEC ECC Option F contract. The management contractors are able to execute all projects allocated to them within a budget cycle. As at 31 May 2016, 122 out of the 155 projects have achieved completion. Therefore, the cost and time analysis is based on the 122 completed contracts.

Nature of the maintenance and upgrading projects

Based on the 155 management contracts analysed, fourteen different types of projects were undertaken in schools (see Table 3).

Table 3: Nature of the maintenance and upgrading works done by management contractors

MAINTENANCE AND UPGRADING PROGRAMME	NO. OF PACKAGE ORDERS
Additional classrooms	10
Emergency maintenance	51
Fencing	1
Fire reticulation (Width N&S)	1
Flood damage disaster relief	7

Mobile ablutions	9
MOD centre sports fields	10
MOD fencing	4
New school	1
QIDS-UP Heat pumps	5
QIDS-UP Hostel maintenance	6
QIDS-UP Hostel equipment	18
Scheduled maintenance	28
Width N&S (norms and standards)	4
TOTAL	**155**

Notes

QIDS-UP – Quality Improvement, Development, Support and Upliftment Programme

MOD – Mass participation; Opportunity and access; Development and growth

Width N&S – "Width Initiative" Minimum Uniform Norms and Standards for Public School Infrastructure

The majority of works (80%) relate to emergency, scheduled and hostel maintenance and the provision of sports fields and additional classrooms. The planning and execution of such works can be complicated with difficulties relating to access constraints, interaction with the building occupants, and working at multiple sites and remote areas that may be up to 400km away from the contractor's base. The project cost breakdown for 15 projects (excluding the management contractor's fee) was examined and found to comprise mainly of Contractor's site overheads (11%), professional fees (6%) and construction cost (83%).

Cost analysis of management contracting projects

Table 4: Cost performance of projects implemented by MC1

MC1	Frequency / Amount (1£ ~ R17.5)
Number of package orders completed by MC1	29
Total value of package orders at start	R 74,986,805
Final value of package orders at finish	R 79,238,433
Difference	R 4,251,629
Percentage difference (%)	**+ 6%**

The cost performance of projects implemented by the two management contractors is summarized in Tables 4 – 6. A separate analysis of projects implemented by each contractor is presented followed by a combined analysis.

As demonstrated in Table 4, of the 29 contracts completed by MC1, the total cost overrun (the difference in price between the final amount paid to the contractor and contract price when the contractor was instructed to execute a contract) is 6%.

Table 5: Cost performance of projects implemented by MC2

MC2	Frequency / Amount (1£ ~ R17.5)
Number of package orders completed MC2	93
Total value of package orders at start	R 89,942,786 (~£5.1m)
Final value of package orders at finish	R 92,997,069 (~£5,3m)
Difference	R 3,054,283 (~£
Percentage difference (%)	**+3%**

The total cost overrun on contracts completed by MC2 is 3% (see Table 5). A combination of cost performance of all 122 projects indicates an overrun of 4.43% (see Table 6).

Table 6: Overall cost performance of management contracting projects (MC1 and MC2)

MC1 and MC2	Frequency / Amount (1£ ~ R17.5)
Number of package orders completed	122
Total value of package orders at start	R 164,929,591
Final value of package orders at finish	R 172,235,503
Difference	R 7,305,912
Percentage difference (%)	**+ 4.43%**

Overall, the evidence in Tables 4-6 demonstrates that the WCED programme managers, management contractors and others in the supply chain have been effective in controlling costs on the 122 contracts on a continuous basis. The management contractors price work undertaken by themselves and subcontractors with price lists. The contractor is, in terms of this payment arrangement, paid the price for each lump sum item in the price list that has been completed and, where a quantity is stated in the price list or schedule, an amount calculated by multiplying the quantity which the contractor has completed by the rate. (Watermeyer, 2012).

In some cases, provisional sums are used in the price lists for items where the work is known but they cannot for various reasons be priced e.g. where a roof is to be replaced but the extent of repair required on the existing roof structure is unknown. Thus, any provisional amounts included are to cover uncertainties associated with identified work. Also, contingency amounts were occasionally included in estimates to allow for risk. In one price list, a contingency allowance of 10% was found included in the project estimate.

Rationale for adoption of the management contracting system

One of the study objectives was to identify the rationale for adopting the management contracting approach used for maintenance, repair and upgrading of infrastructure in schools in the Western Cape. The Western Cape Government in December 2009 designated the WCDTPW as the preferred implementer for the province. However, public works has limited

capacity to provide a full and efficient scale of service as implementer for all infrastructure needs. Therefore, the decision to appoint management contractors in 2014 was for the purpose of supplementing infrastructure services required by the Western Cape Education Department and Western Cape Department of Health. The two Departments jointly set up a common framework contract of three years' duration that provided a basis for call offs for maintenance, repair and upgrading works in schools and hospitals in the Western Cape to provide additional capacity for the maintenance, repair and upgrading of infrastructure in schools in addition to that of public works. The management contractors assume responsibility for design and implementation and the client essentially has one only main relationship to manage (see Figure 2).

Time analysis of management contracting projects

Time performance of the 122 projects implemented by the two management contractors is summarized in Table 7. Approximately 65% of contracts were completed within 7 days of the required completion date. It should be noted that the comparison is based on actual time for completion with the required 'completion date' as on award rather than the completion date as modified for changes and so on throughout the contract.

Table 7: Time performance of projects implemented by management contractors

SYSTEMATIC ANALYSIS OF TIME	NUMBER	%
Completion before original date	7	6%
Completion on original date	9	7%
Completion within 7 days of contractual date	64	52%
7 to 30 days after original completion date	11	9%
30 to 45 days	9	7%
45-60 days	9	7%
60-90 days	6	5%
More than 90 days	7	6%
TOTAL	**122**	**100%**

Analysis of professional services costs associated with projects implemented by management contractors

The estimation of professional costs associated with the management contracting projects requires a number of factors to be taken into account including the project management component of the management contractor's fee, fees for the management contractor's professional service providers, fees for any professional service providers appointed by the client, and the employment costs of the client's programme management team (see Figure 2 for contractual roles and relationships in the management contracts). Table 8 presents only an estimation of the professional costs of the management contractor's consultants (these may include design consultants, electrical engineers, and structural engineers). Therefore, the other costs should be added to this estimate for an approximation of the full professional cost of the system.

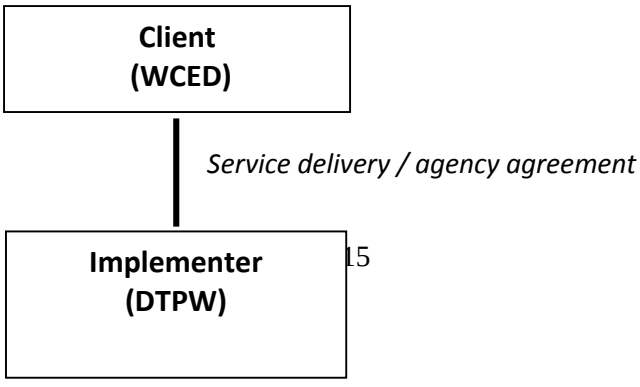
Table 8: Analysis of professional services costs associated with projects implemented by management contractors

MEASURE	AMOUNT (1£ ~ R17.5)
Total value of 42 package orders	R 119,789,606
Professional fees for the 42 package orders	R 5,702,726
Professional fees stated as %	**4.76%**

The evidence in Table 8 is based on the analysis of professional fees for 42 projects implemented by management contractors between 2014 and 2016. The magnitude of the professional fees, as a percentage of total value of the package orders (i.e. contractor's site overheads, professional fees, construction cost), is 4.76%. The management contractor's Fee under the NEC3-ECC Option F includes the contractor's management (project, procurement and administration of contracts), office overheads, insurances, finance charges and profit. These fee percentages, which included travel from Cape Town to the site, ranged from 8 to 12.5%. Approximately twenty per cent of this amount represents the contractor's project management services, based on Fee percentages tendered on other projects, i.e. 1.6 to 2.5 %. This increases the fees for professional services to between 6.4 and 7.3%. The employment cost of the professional quantity surveying firm providing cost consultancy services for the management contracts was assessed at being approximately R 4,0m or 2.3% to the estimate based on the total management contracts value of R 172,235,502 (see Table 6). This amount needs to be added to obtain a high level comparison. Accordingly total professional costs of the management contracting system can be approximated to somewhere between 8.7% to 9.6% (~9,2% point estimate). This amount excludes professional services provided by programme managers in the infrastructure department.

Analysis of projects implemented by WCDTPW

The results presented in this section cover the nature, cost analysis, time analysis and professional fees associated with the projects managed by public works. The analysis is based on 50 maintenance and upgrading projects in schools in 2015/2016. The 50 projects are located in 29 different locations/towns in the Western Cape. The total value of the 50 package orders is R 137,485,895 (~£7.9m) (AVG R2.75m (~£0.16) per contract). 39 different contractors have been used for the delivery of the 50 projects – all of which were contracted following a competitive tender process. The 35 public works projects examined are based on JBCC or NEC3 contract. The analysis of tender documents and bill of quantities indicate that some of the projects are done by contractors appointed on 3-year framework contracts basis. 16 different principal agents are involved in the delivery of the 50 projects. Most of the principal agents (about 90%) are quantity surveying firms. As at 31 May 2016, 35 of the 50 have achieved practical completion. Therefore, the cost and time analysis is based on the 35 completed projects. Figure 4 shows the nature of contractual relationships in projects with public works as implementer.



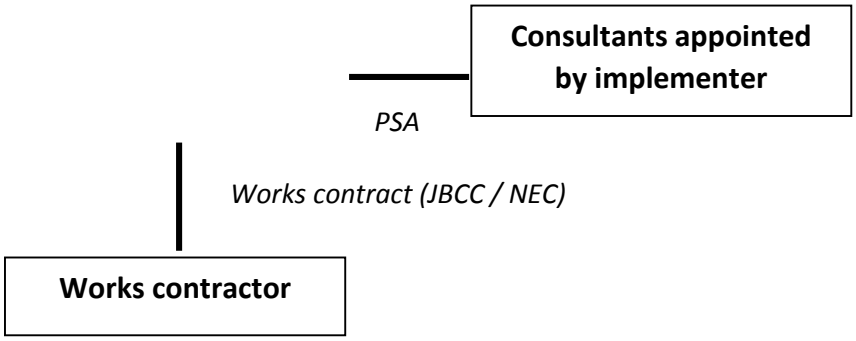


Figure 4 Contractual relationships in projects with public works as implementer

KEY

Contractual relationship

PSA – Professional Services Agreement
DTPW – Western Cape Department of Transport and Public Works
WCED – Western Cape Education Department

As demonstrated in Figure 4, the WCDTPW scenario is more complex because they use the consultants to manage the maintenance and upgrading projects as well as professional services providers (PSPs). In addition to these teams there is a WCDTPW Architect and five Works Inspectors who are staff of the WCED infrastructure department.

COST analysis of completed projects

Table 9: Cost performance of projects implemented by DTPW

Projects by public works	Frequency / Amount
Number of package orders completed	35
Total value of package orders at start	R 93,042,433
Final value of package orders at finish	R 76,322,391
Difference	R -16,720,042
Percentage difference (%)	**-18%**

Note – amounts based on finalised figures in project files but not final accounts

A superficial analysis of cost performance of projects implemented by the WCDTPW is presented in Table 9. It should be noted that the comparison is based on amounts paid out with Prices at the time of award rather than Prices having allowed for e.g. changes and employer risks through the period of the contract.

The 35 projects have all reached practical completion. However, as at 31 May 2016, which is nearly a year since some of the projects achieved practical completion, final accounts were only available for 6 projects. Therefore, the analysis presented in Table 9 is based on current expenditure amounts rather than the more conclusive amount in final accounts. A finalisation

of the analysis may be necessary once all final accounts are available. For the six projects with final accounts, the cost performance is presented in Table 10.

Table 10: Cost analysis of DTPW projects based on final accounts

Number of package orders with final accounts	6
Total value of package orders at start	R 19,522,809
Final value of package orders at finish	R 18,400,127
Difference	R -1,122,682
Percentage difference (%)	**-5.75%**

Details of the six projects with final accounts are presented in Table 11. Time analysis of the six projects indicates that four finished 6-15 days before time and two finished on time.

Table 11: Detailed analysis of projects with final accounts of projects implemented by DTPW

EMS No	PO AMOUNT	FINAL COST	DIFFERENCE	%
0130330043	3,830,032	3,642,677	-187,355	-4.9%
0130333344	3,214,541	2,980,227	-234,314	-7.3%
0108470120	2,276,046	2,163,487	-112,559	-4.9%
0109322342	4,733,574	4,441,190	-292,384	-6.2%
0108470449	3,205,718	3,009,770	-195,948	-6.1%
0108477214	2,262,898	2,162,776	-100,122	-4.4%

Notes
EMS No – System for project identification
PO – Purchase Order

Contingencies and provisional allowances in cost estimates
It was considered necessary to closely examine how projects were priced to develop a better understanding of the extent of provisional sums and contingencies included in cost estimates. A significant use of contingencies and provisional allowances in the project estimates means the cost performance in Table 9 and 10 needs to be interpreted within that context. Based on an examination of 30 tender documents, it was found that projects are generally priced using bill of quantities or price lists. Out of 30 tender documents examined, 26 were based on price lists and 4 on bill of quantities.

The extent of contingencies in three projects priced with bill of quantities is presented in Table 12. The fourth project priced with bill of quantities had no contingency allowance. However, there were provisional sums in nearly all bill of quantities and price lists. In the bill of quantities, contractors priced items such as plumbing and drainage works simply based on the provisional sums indicated by consultants. The extent of provisional allowances in some project based on price lists is presented in Table 13.

Contingency sums

Contingency sums in three projects priced with bill of quantities were analysed and summarized in Table 12. ISO 6707-2 (2014) (Buildings and civil engineering works — Vocabulary — Part 2: Contract terms) defines a 'contingency sum' as a sum of money budgeted for or included in a contract to cover construction work that can be required, but cannot be foreseen or predicted with certainty. In all three cases, the contingency was found to be a fixed amount of R350 000 added on top of the total estimated project cost.

Table 12: Contingency allowances in bill of quantities of projects implemented by DTPW

FINAL TENDER SUMMARY	Project A	Project B	Project C
Preliminaries and general	105879.6	45000	150000
Work to be done (alterations, roof coverings, carpentry and joinery, ceilings partitions and access flooring, ironmongery, metalwork, plastering, tiling, plumbing and drainage, glazing, paintwork, external works, electrical work)	2352880	2423276	2109134
JBCC document	600	600	600
SUBTOTAL	2459360	2468876	2259734
Plus 14% VAT	344310	345642	316363
SUBTOTAL	2803670	2814519	2576097
Allow the sum of R 350 000 (Three hundred and fifty thousand Rand) for contingencies to be spent in whole or in part or be deducted in its entirety at the discretion of the Agent/Representative	350000	350000	350000
TOTAL	3153670	3164519	2926097
Allowance for contingencies (%)	**11.10%**	**11.06%**	**11.96%**

The analysis demonstrates that the contingency allowances are between 11-12%. The closeness of the percentage value of the contingencies is mainly because the projects examined have significantly similar values. In one case, the electrical item in the bill of quantities had a significantly small contingency amount included within that section of the bill. Thus, in addition to the general project contingency, a specific section of the bill may contain its own contingency for risk.

The pricing for plumbing and drainage items in the bill of quantities was based on provisional sums inserted by the contractor based on a description of the works to be done. An approximation of the percentage value of plumbing and drainage items came to 4% of the total contract value. External works was also priced using provisional sum in one of the bill of quantities. Therefore, it may be concluded that about 15% of the contract value is based on contingencies and provisional sums in some cases.

Provisional allowances

The extent of provisional allowances in some price lists of projects implemented by WCDTPW is summarized in Table 13.

Table 13: Provisional allowances in price lists

ITEM	Project C	Project D	Project E	Project F
Preliminaries and General Costs	215 000	211 964	277 274	220,439
Alterations, Demolitions, Etc.	101 729	170054	573990	1,095,577
Roofing covering	–	726142.7	1735770	10,200.00

Carpentry and Joinery	40 909	–	–	24,420
Ceilings, Partitions, Access Flooring	17 294	47037	22320	26350
Floor Coverings, Wall Linings, Etc.	42 822	55080	15700	–
Ironmongery	202 395	–	–	19,005
Metalwork	145 011	–	–	18,750
Plastering	22 557	–	–	–
Tiling	24066	63572	4350	163,770
Plumbing and Drainage	228 628	134885	193985	5,885
Glazing	1 236	–	–	5,220
Paintwork	127 908	154460	670865	886,710
Fencing, Etc.	23 659	–	–	–
External Work	428 585	187449	150000	40,000
Provisional Allowances	495 000	330000	330000	360,000
SUB TOTAL	2 116 799	2,080,644	3974254	2,876,326
VALUE ADDED TAX 14%	296351	291290	556395	402,686
TOTAL	2 413 151	2371935	4530649	3,279,011
Provisional allowances (%)	**21%**	**14%**	**7.3%**	**11%**

ISO 6707-2 (2014) defines a ‘provisional sum’ as a sum of money that is included in a contract for work that is foreseen but cannot be accurately specified at the time the tender documents are issued. In all four cases, the provisional sums were for electrical works and included builder's mark-up (5%) and general attendance (5%). For works based on provisional allowances, “the Contractor is required to obtain and submit three (3) quotations to the Principal Agent for approval before the work proceeds.

TIME analysis of completed public works managed projects

Time performance of the 35 completed projects implemented by public works is summarized in Table 14.

Table 14: Time performance of projects implemented by DTPW

SYSTEMATIC ANALYSIS OF TIME	NUMBER	%
Completion before original date	8	23%
Completion on original date	9	26%
Completion within 7 days of contractual date	0	0%
7 to 30 days after original completion date	5	14%
30 to 45 days	5	14%
45-60 days	3	9%
60-90 days	5	14%
More than 90 days	0	0%
TOTAL	**35**	**100%**

Approximately 49% of the contracts were completed by the required completion date at start. 23% of contracts actually were completed before the required completion date. A deeper understanding is needed of the underlying reasons or the context of this observation.

Analysis of professional services costs associated public works projects

The estimation of professional costs associated with public works projects requires the following factors to be taken into account: fees for professional consultants, employment costs of public works staff, and employment costs of any members of the client's team (see Figure 3 for contractual roles and relationships in projects managed by public works).

Table 15: Analysis of professional fees associated with projects implemented by DTPW

MEASURE	AMOUNT
Total value of 50 package orders	R 137,485,895
Total professional consulting fees	R 21,450,052
Professional fees %	**15.6%**

Table 15 presents only an estimation of the professional costs of the professional consultants. It should be noted that the professional fees in Table 15 are not based on final account figures hence the estimate should be viewed in minimum terms. The costs of any professional services provided by programme managers in the infrastructure department and staff of the WCDTPW are not included in this estimate.

9 Comparison and Discussion of Results

In this section, the differences in outcomes between the MC projects and those implemented by the public works is presented followed by a discussion on cost performance, time performance and then professional services costs.

Comparison of projects implemented by management contractors with projects implemented by public works

The comparison of projects implemented by public works with those implemented by management contractors is summarized on the basis of cost performance, time performance, and scale of professional fees (see Table 16).

It should be noted that the estimation of cost and time performance was based on expected and actual values stated in project documents. It was not possible to ascertain how time was estimated in the first place to determine the extent of time risk allowances in programmes.

Cost performance

The cost performance of projects implemented by public works in 2015/16 was compared with cost performance of projects implemented by management contractors in 2014-2016. For the management contracts, cost performance of 122 management contracts was analysed. However, only 6 of the 35 public works projects had final accounts and hence the analysis of cost performance of the public works projects was based on the 6 projects.

What is apparent from the data available for comparing the cost performance outcomes between the two approaches which operate under a common governance system is that the management contractors are able to close out projects much more quickly than the principal agents on those projects managed by the WCDTPW.

The examination of bill of quantities and price lists demonstrated that management contractors placed less reliance on the use of provisional sums to arrive at a price at the start of the project. This is probably due to earlier contractor involvement which was possible in the management contracting approach.

The data presented in Table 6 and Table 10 indicates the cost performance of 6 public works projects with final accounts as – 5.75% whereas the cost performance of 122 management contracts was +4.47%. These figures suggest a difference in approach to the management of contingencies. The WCDTPW approach entails building contingencies into the contract price so that contingencies are managed through the individual contracts rather than at a programme level. As a result, the quantum of the contingencies that can be released to fund additional projects during a financial year is only known when the final amounts are known. The management contractor approach allows contingencies to rather be managed at a programme level. This coupled with a quicker turnaround time in closing out final accounts allows contingencies to be released for other projects. This is important where departments have fixed budgets for a financial year. It was not possible to compare the unit costs of the work performed in terms of these two approaches.

Earlier in the literature review, the cost performance of projects implemented by public works in all provinces was presented based on a National Treasury (2015) report (see Table 2). The practice of including contingency amounts routinely in contracts as is the case with the projects managed by WCDTPW distorts the performance reporting in Table 2. As a result, comparisons will be misleading.

Table 16: Comparative analysis of projects by DTPW and management contractors

Variables	Public Works managed projects	Management contracting projects
Time period of projects analysed	2015-16	2014-2016
Number of completed projects analysed	35	122
Form of contract	JBCC, NEC	NEC
Pricing strategy	Bill of quantities, price list	Price lists
Contingencies	Yes	Yes
Provisional allowances	Yes	Yes
Total value of the package orders at start	R 93,042,433	R 164,929,591
Total value of the package orders at finish	R 76,322,391	R 172,235,503
Difference between initial and final cost of completed projects (based on final accounts)	-5.75%	4.43%
Number of projects finished before or on the planned completion date	49%	65%
Fees for professional services	15.6%	8.7% – 9.6% (9.2%)

Time performance

The analysis of time performance in projects implemented by public works and those implemented by management contractors shows that 49% of public works projects are finished within 7 days of the required completion date (see Table 14). In comparison 65% of

management contracts finished within 7 days of the required completion date (see Table 7). Earlier in the literature review, the time performance of projects implemented by public works in all provinces in 2013/2014 was summarized in Table 2 based on a National Treasury (2015) report (see Table 2). In the Western Cape where the fieldwork for the research reported in this paper was conducted, only 13% of new construction projects were delivered on time. However, when it came to maintenance projects, 51% were completed on time (see Table 2). Therefore, there is significant alignment between the time performance of maintenance projects examined in the current study and time performance of the maintenance projects implemented by public works in the Western Cape in 2013/2014 (see Table 2 which is based on National Treasury provincial database). The 65% of management contracts that completed by the required completion date is a significantly higher output and therefore the management contracts may be described to be more efficient in terms of how the system was implemented in the case examined. This finding is not unexpected due to the early contractor involvement permitted in terms of the management contractor approach.

Professional services costs of project implementation

The professional costs associated with the projects implemented by management contractors and those implemented by public works are presented in Table 8 and Table 14 respectively. The professional services fees associated with the management contractor were 8.7 – 9.6%. The comparable minimum fees for those projects executed by WCDTPW were 15.6% although anecdotally programme managers described this to be in the range of 18-22% in practice. Therefore, the professional cost of projects implemented by management contracts is significantly lower than that of public works projects, ignoring the cost of procuring the consultants.

It should be noted that the estimates here represent only the fees for professional services providers who typically include architect, electrical engineer, structural engineer, civil engineer, and quantity surveyor. The employment costs of programme management staff associated with the two project implementation approaches can also be considered to ascertain whether or not the programme management costs are higher for one of the approaches. The scope of this paper does not include estimation of programme management costs. However, based on the data presented in Figures 2-4, it is indicative that WCDTPW maintenance and upgrading projects have a bigger complement of programme management staff than management contracting maintenance projects.

10 Conclusions

The research aim was to evaluate and compare the performance and professional costs of projects implemented by public works with that of management contractors. The conclusions of the study are as follows:

- The main reason for appointment of the management contractors was due to lack of capacity on the part of the WCDTPW to serve as implementer for all projects. The appointment of the management contractor by the WCED enabled expenditure on maintenance, repair and upgrading of schools to be almost trebled
- One condition for successful implementation of the management contracting system in the public sector context is how the system is successfully integrated with public sector governance, auditing and the delivery management framework.

- The findings relating to management contracting projects are presented in Table 4 to Table 9. Approximately 65% of projects completed on time and the total cost overrun of 122 contracts over 30 months is +4.43%. The results significantly demonstrate efficiency and a 'good' level of 'certainty' of delivery in terms of time and cost. The management contractors were able to agree final accounts and close out projects more quickly than the principal agents managed by WCDTPW. This coupled with the management of contingencies at a programme level and less reliance on provisional sums, enables budget to be released for other projects which in turn enables the WCED to spend their allotted budget for a financial year. The time performance of management contractors appeared significantly better than that of contractors appointed and managed by the WCDTPW. The time and cost certainty advantages offered by the management contractor approach over the traditional approach implemented by DTPW may be attributed to the fact that the approach was delivered through a long term framework and allowed a degree of early contractor involvement. The findings demonstrate that significant cost savings in professional fees can be achieved in the management contractor approach.
- The findings relating to projects managed by WCDTPW are presented in Tables 9 to 15. 49% of the 35 projects examined were delivered on time and the 6 projects with final accounts available all finished within the estimated budget which included significant contingency and provisional sums. The practice of routinely including contingency and provisional sums in contracts distorts the cost performance analysis and superficial comparison of this result with the management contracts can be misleading.
- The following advantages demonstrate the value of the overall management contractor approach that was used over the traditional contracting or project implementation approach
    - Early contractor involvement
    - Successful delivery of projects within budget cycle
    - Cost and time certainty, which has value to a client
    - Better value for money in terms of professional fees also taking into account that the management contractor is responsible for everything and the client has fewer relationships to manage
    - Collaborative maintenance and upgrading solutions in remote areas particularly
    - Provides immediate capacity for timely and efficient maintenance and upgrading solutions
    - Framework agreement resulted in significant savings on tendering costs – more than 150 projects delivered under the same framework agreement
    - Framework contract helped to activate projects quickly – over 150 contracts in 3 years
    - Collaboration and efficiencies resulting from on-going and maturing relationships and working practices

- Value for money can be defined as the optimum use of resources to achieve intended project outcomes. The critical starting point in delivering value for money through infrastructure projects is to align such projects with strategic objectives, priorities, budgets and plans, and thereafter, during the planning phase, to clearly define objectives and expected outcomes, as well as parameters such as the timelines, cost and levels of uncertainty. This frames the value-for-money proposition that needs to be implemented at the point in time that a decision is taken to proceed with a project, i.e. it establishes "economy." The end point is to compare the projected outcomes against the actual outcomes, i.e. to confirm the "effectiveness" of the project in delivering value for money (Watermeyer, 2013). The gap between what was planned and what was delivered was narrower in the MC model than in the traditional model. This suggests that the MC contracts delivered better value for money than the traditional contracts.

- The positive outcomes observed is the result of a combination of strategies in the overall MC approach e.g. framework contract, ECI, managing risk at programme level rather than project level / less use of provisional and contingency sums and possibly use of NEC3 ECSC. It may be necessary to consider this further and differentiate between the benefits which can largely be ascribed to management contracting and those which can be ascribed to practices brought in by the management contractor which a client in a similar position could also use, regardless of whether they use the management contracting approach or not.

- Finally, the evidence in this paper seems to contradict two major assertions in the construction management literature. First, management contracting is often described as a system suitable for fairly large and complex projects and refurbishment projects. Here, however, management contracting was well suited to maintenance and upgrading of spatially diverse and relatively small value projects and it brought considerable advantage. Second, the literature generally characterises management contracting as a procurement method with 100 per cent subcontracting feature. Here, however, MC2 performed most of the maintenance and upgrading work by itself. Therefore, the management contracting model here is not the same as management contracting in the traditional sense.

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