

# **Delivering infrastructure at scale in developing countries: numbers or systems?**

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## **ABSTRACT AND KEYWORDS**

### **Purpose**

To present an alternative delivery model that can deliver infrastructure at scale within an African context.

### **Approach**

Research as to how infrastructure could be delivered at scale without compromising the delivery of social and economic deliverables indicated that a fresh approach to delivery was required.

eThekwini Water and Sanitation implemented this fresh approach to delivery on a large scale project on a pilot basis. Framework contracts with a limited number of “supply chain” contractors were entered into to deliver infrastructure and a number of deliverables relating to poverty relief, enterprise development and training over a three period. Use was made of NEC3 Engineering and Construction Option C Target Contract and the CIDB specification for Social and Economic Deliverables in the Construction Works Contracts.

### **Findings**

The pilot project not only delivers infrastructure at scale but also provides significant temporary employment opportunities to the unemployed, facilitates the growth and development of small local contractors and permits a wide range of training to take place. It requires only one eThekwini staff member to oversee its implementation.

### **Value**

The delivery model demonstrates that framework arrangements with large contractors can not only delivery projects at scale but also on a wide range of social and economic deliverables.

**Keywords:** Target contract, infrastructure delivery, public sector, construction works

## **INTRODUCTION**

The Construction Industry Development Board (CIDB), established as a statutory body to stimulate sustainable growth, reform and improvement of the construction sector, recognised that construction output within South Africa needed to double in size over a 5 to 10 year period to meet growing demand. It also acknowledged that several government departments and municipalities were struggling to spend their allotted capital budgets for a number of reasons. The CIDB (2006) in response to this challenge issued a practice note "Scaling up delivery and accelerating empowerment" which advocated the use of larger, longer contracts and the adoption of a programmatic and systematic approach to delivery.

The Expanded Public Works Programme (EPWP), one of the South African Government's short-to-medium term programmes aimed at alleviating poverty and reducing unemployment, spent about US\$ 360 million during the 2004 / 2005 financial year on infrastructure. The Expanded Public Works Support Programme (2006), a Project of the Business Trust, analysed the spending on these projects and found that on the 4478 municipal infrastructure grant projects registered with the Department of Provincial and Local Government, with a total value of US\$ 1,3 billion, the average size of projects was a mere US\$ 0,3 million, while only 2% of the projects exceeded US\$ 2 million. They also found that the average size of projects implemented by the provincial departments was US\$ 0,2 and only 1,4% of projects exceeded US\$ 2 million. Cabinet raised concerns about the small size, limited impact and limited visibility of these many EPWP projects.

The Business Trust commissioned the development of a new delivery model against this background. eThekweni Water and Sanitation Unit (Durban), with the support of the CIDB, piloted its implementation in the replacement of the city's asbestos cement water mains.

## **CURRENT PUBLIC SECTOR CONSTRAINTS TO INFRASTRUCTURE DELIVERY**

### **The public sector skills shortage**

Lawless (2005) found that there are no civil engineers, technologists or technicians whatsoever employed in 34% of South Africa's local municipalities and 9% of district municipalities. Only one civil technician was employed in 18% of the local municipalities and 9% of district municipalities while 16% of local municipalities and 13% of district municipalities employed only technologists and technicians under the age of 35. Only 19% of local municipalities and 53% of district municipalities have at least one civil engineer in their employ.

A rough comparison of the distribution of engineers and technologists in South Africa in 1967 and 2005 can be made by comparing the figures published by Terblanche (1971) and Lawless (2005), see Table 1. What is

clearly evident from Table 1 is that there has been a major flow of technologists and engineers from the public sector to the consulting sector over time.

**Table 1** Change in distribution of technologists and engineers in South Africa over time (after Terblanche (1971) and Lawless (2005))

Employer	Percentage distribution (%)	
	1967	2005
State owned enterprises	12	6
Government including provincial	12	4
Local government	15	10
Consultants	31	51
Industry or business	28	23
Academia	2	6

### Current delivery practices

Virtually all public sector infrastructure projects in South Africa are currently delivered using a traditional preplanned approach to construction which requires that the design and specifications be adequately developed and approved by clients before tenders are invited. This approach enables the design to meet the client's requirements closely and the contract when awarded can proceed without major change, delay or disruption. This model works best when:

- the public authority has adequate in house capabilities and capacity to either undertake the design or to brief consultants and to oversee the design process; and
- there is adequate time to complete the design and associated documentation before tenders for construction are invited.

Public authorities are today under pressure to deliver projects, on time, on budget, within shorter time frames. This has led to the "fast tracking" of the traditional preplanned approach to construction by the streamlining of procedures to minimise delays between activities and to permit activities to be undertaken out of sequence. This has resulted in tenders for construction works being awarded where the works are not fully or precisely scoped. In many instances, this has led to very disappointing outcomes e.g. the final cost of the construction works for the 2010 world cup stadia has increased by approximately 100% from the time that tenders were awarded to the time that contracts will be completed.

Currently most public sector clients don't have internal design staff and outsource the design to consultants. Projects are commonly broken down into small contracts to provide access to local contractors and to encourage labour based technologies; the theory being that smaller contractors are best able to implement employment intensive works. This

delivery model, however, results in a consultant driven, stop / start mode of delivery, often with disappointing outcomes.

### **Underlying reasons for current capacity constraints**

The CIDB (2006) attributed the capacity problem within government to deliver infrastructure to:

- the project approach whereby, for each and every project, consultants are appointed, briefed, directed and overseen by a gradually disappearing cadre of skilled staff; and
- unbundling strategies aimed at reducing the size of contracts in order to target small or local enterprises in order to satisfy social and economic imperatives, which place increased demands on the client's resources to manage and oversee these small contracts.

It may be also be argued that capacity constraints exist due to the continued use of an delivery approach which no longer matches the capabilities and capacities of the client to effectively oversee its implementation, ignores the capabilities of the private sector and fails to accommodate current delivery imperatives.

### **THE SEARCH FOR AN ALTERNATIVE DELIVERY MODEL**

Watermeyer *et al* (1998) demonstrated a little over a decade ago that a range of targeted procurement procedures developed in South Africa by government's Procurement Reform Task Team could be successfully used to link significant employment and business opportunities to large construction works contracts. In fact, these procedures have over time become so well documented and developed that they have been incorporated into a number of South African national standards (Watermeyer, 2004) and are currently being converted into a series of international standards. As a result, there was no need to search for models and approaches to achieve social and economic deliverables through large construction contracts.

International approaches used by multilateral banks which are embedded in the conditions of contract published by FIDIC (2006) offered more of the same – the traditional pre-planned approach. However, the approaches to infrastructure delivery adopted in the United Kingdom in the wake of a series of reports aimed at improving the efficiency of the UK construction industry e.g. Constructing the Team (Latham Report) and Rethinking Construction (Egan Report), did offer a number of alternative options.

The Office of Government Commerce's (2006) Common Minimum Standards require that procurement strategies and contract types support the development of collaborative relationships between the government client and its suppliers and facilitate the early appointment of integrated supply teams. This Standard also states that "traditional, non-integrated

procurement approaches should not be used unless it can be clearly shown that they offer best value for money – this means, in practice they will seldom be used.”

It was noted that the Office of Government Commerce has only endorsed the NEC family of contracts for use in public projects in the UK. An examination of the NEC3 Engineering and Construction Contract revealed that this form of contract not only provides a priced contract as is commonly the case in other forms of contract such as those promoted by development banks, but also a target contract, a cost reimbursable and a management contract option.

The targeted procurement and NEC3 contracting system accordingly formed the basis for the alternative model that was developed.

### THE MODEL

Typically at the commencement of any programme (series of projects), the only “knowns” are the allocated medium term budget, a list of short term priorities and possibly an indicative broad brush breakdown of the budget into prioritised projects for the first year of the programme. Individual projects within a programme need to be scoped, designed and documented so that construction may take place. This cycle needs to be repeated so that as projects are identified, they can be scoped, designed and documented so that construction occurs on a continuous basis over the period of the programme (see Figure 1). Accordingly, the delivery model needs to be capable of procuring services in the absence of a well defined scope of work.

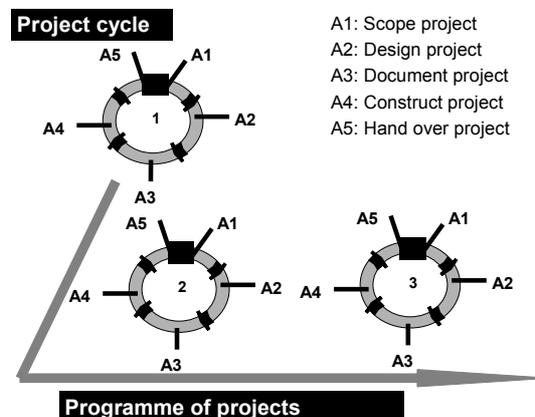
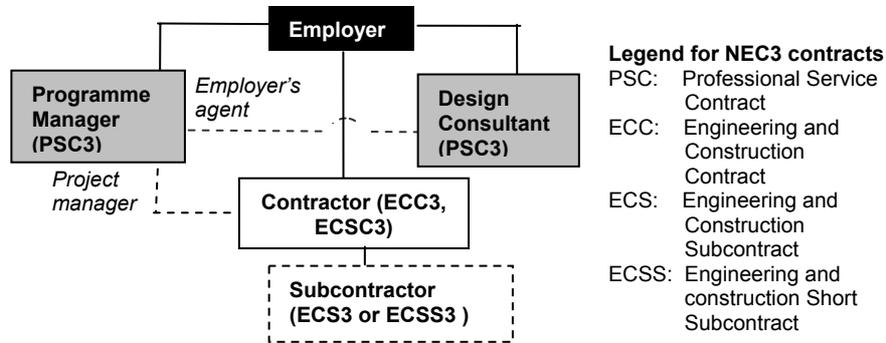


Figure 1 Project cycle within a programme of projects (Watermeyer *et al*, 2007)

In terms of this model, the client identifies a programme comprising a number of projects and obtains the necessary funding for it. The client thereafter procures the services of a Programme Manager and one or more Design Consultants and Contractors in terms of a competitive

procurement process in the absence of any detailed scope of work using the NEC3 family of standard contracts published by the Institution of Civil Engineers, London (see Figure 2) and the CIDB Standard for Uniformity in Construction Procurement (Watermeyer *et al*, 2007).

The Programme Manager converts the budget into a series of works packages, manages the delivery of the works, acts as the Employer's Agent in terms of the Design Consultant's contracts, acts as the Project Manager in terms of the Contractor's contract and provides cost consultancy services. The Design Consultant provides design services in relation to the identified work packages and monitors the quality of the constructed works. The Contractor constructs the works associated with an identified works package.



**Figure 2** Contractual relationships in the model (Watermeyer *et al*, 2007)

The Contractor, prior to commencing the work, agrees a target price with the Project Manager based on an activity schedule developed from the specifications and drawings provided by the Design Consultant for the identified package of work. During the course of the contract, the Contractor is paid his costs as defined in Option C of the NEC3 Engineering and Construction Contract, based on his tendered cost parameters and at the end of the contract, the Contractor is paid his share of the difference between the target price and his cost according to an agreed formula. If the final cost is greater than the target cost, the Contractor pays his share of the difference. This motivates the Contractor to control costs (Watermeyer 2009).

The Design Consultant is typically paid on a time and cost basis (Option E of the NEC3 Professional Service Contract) until such time as the precise scope of work is known and a target contract can be agreed with the Design Consultant (Option C).

Tenderers compete on the basis of price and quality for the programme management, design consultancy and construction services. Typically, the professional service providers tender staff rates and certain cost parameters relating to expenses while contractors tender a range of parameters associated with the NEC3 Schedule of Cost Components i.e.

- a direct fee percentage;

- a subcontracted fee percentage;
  - time related charges for equipment;
  - a percentage for working areas overheads;
  - a percentage for manufacture and fabrication overheads;
  - a percentage for design overheads; and
- hourly rates for specified personnel and equipment.

Tender assessment schedules are used to develop a comparative price for evaluation purposes, based on assumed quantities of hours and amounts and the tendered cost parameters (percentages and rates).

The CIDB's generic Specification for Social and Economic Deliverables in Construction Works Contracts (2007) can be used in conjunction with this model. This specification provides for the delivery of a wide range of social and economic deliverables through the performance of a construction contract as set out in Table 2.

The deliverables outlined in Table 2 may be readily incorporated into the scope of work associated with a particular work package by reference to this specification and the completion of project specific variables (specification data). Contractors may be required to achieve a particular deliverable and be penalised financially should they fail to do so or be offered a financial incentive should they equal or exceed a key performance indicator associated with a deliverable. The target price that is developed for each work package takes into account these requirements.

This approach of addressing the social and economic agenda is very flexible and, unlike most other delivery models, allows the client to change the deliverables over time in response to emerging needs and changing circumstances. This is of particular value where the contracts extend over a few years.

## **THE PILOT PROJECT**

eThekwini Water and Sanitation maintains some 13 000km of water mains in the Durban area of which about 2 500km are aging asbestos cement pipes. These old asbestos cement pipes are at the end of their useful life, burst frequently and need to be replaced. eThekwini adopted the delivery model outlined in this paper which allows the target price associated with each water district to be established once the scope of work and socio-economic deliverables have been finalized.

The concept of the model using Option C (Target Cost) of the NEC3 Engineering and Construction Contract was introduced to the Design Branch of eThekwini Water and Sanitation in February 2007. (The Branch had not previously used the NEC3 Form of Contract). The decision to proceed with the model was made mid February after a briefing meeting which was attended by select officials, contractors and consultants. Expressions of Interest were prepared in accordance with the CIDB's Standard for Uniformity in Construction Procurement, advertised on 9 March and closed on 23 March. Submissions were evaluated and the successful respondents were invited to proceed with the preparation of a

tender in accordance with the CIDB's Standard Conditions of Tender on 7 May. Tenders for the Programme Manager and Design Consultants closed on 18 May and for the Contractors on 25 May. From these tenders one Programme Manager, four Design Consultants and four Contractors were selected. These selections were ratified by the Bid Evaluation and Adjudication Committees and contracts were awarded during the last week of June 2007. Work commenced on 1 July 2007 i.e. the start of the new financial year.

**Table 2** Standard social and economic deliverables

Theme	Deliverable	
	#	Description
Employment of local resources	A1	Provide employment opportunities to targeted labour
	A2	Utilise local resources
Employment opportunities in labour intensive works	B1	Provide employment and skills development opportunities to targeted labour
Business opportunities	C1	Provide business opportunities for targeted enterprises
	C2	Procure subcontractors for defined portions of the contract in terms of specified procedures
Enterprise support and development programmes	D1	Provide third party management support services to targeted contractors
	D2	Procure or manage (or both) mentoring services for targeted contractors
	D3	Execute the contract in joint venture with a targeted partner
Skills development	E1	Provide experiential work opportunities towards a specified professional registration for designated persons
	E2	Provide work learning opportunities towards a specified degree, diploma or certificate for designated persons
	E3	Provide experiential work opportunities towards a SAQA registered qualification or certificate for designated persons
	E4	Procure and manage a training provider to provide specific training for designated persons
HIV/AIDS	F1	Promote HIV/AIDS awareness

The construction works contracts that were concluded were for a three year period and were based on the NEC3 Engineering and Construction Target Contract option (Option C). The NEC3 Professional Service

Contract was used for the appointment of the consultants. Use was made of the Construction Industry Development Board's (CIDB) Specification for Social and Economic Deliverables in Construction Works Contracts.

Water districts are assigned to specific consultants and contractors. The target price is negotiated with the contractor after the design of the water network is completed. Districts are handed over to contractors who become responsible for the maintenance of the existing pipe work in the district, including the repair of burst pipes, until such time that the new pipelines are installed, the old pipes are decommissioned and the district is handed back to eThekweni Water and Sanitation.

The learning curve on the project relating to the maintenance of the existing water network and the supplying of households with water while decommission the old pipes and commissioning the new ones was a steep one.

## **THE OUTCOMES OF THE PILOT PROJECT**

Expenditure on this project from a standing start on 1 July 2007 up to 1 September 2008 was approximately US\$ 40 million. Currently up to 80 km of water mains are being replaced each month. Approximately 3800 temporary workers (unemployed persons) are employed on the programme to excavate trenches and are rotated every 4 months to allow others to financially benefit from the construction activities. The total amount of money paid to such workers is about 21% of total project expenditure. 16 subcontractors (or "co-contractors") have been offered work opportunities. These contractors who have annual turnovers ranging from well below US\$ 75 000 to US\$ 550 000, are being developed to increase their share of the construction work from 10% to 20%.

A full time mentor has been engaged to assist the "co-contractors" in the establishing of business systems within their businesses in order to improve their sustainability and to grow their business. Key performance assessments of these contractors are undertaken by the mentor at regular intervals to monitor their progress. The expected annual turnovers of these co-contractors at the end of the contract is expected to be between US\$ 100 000 and US\$ 1 000 000.

Selected workers are provided with training in pipe laying. All workers received HIV/AIDS training. Work place experience is provided by the design consultants to enable eThekweni staff members to gain suitable experience to facilitate their registration as built environment professionals. eThekweni has only assigned one of its senior project managers to interface with the project team through the appointed programme manager.

## **APPLICABILITY OF MODEL TO OTHER AFRICAN COUNTRIES**

Lawless (2005) attempted to quantify the technological challenge facing developing countries by providing an indication of the ratio of engineer to population, based on an extensive desk top survey and the contacting various institutions and registering bodies. Although the data was compiled

from a number of sources of varying detail and reliability, the statistics, some of which are reproduced in Table 3, when linked to per capita gross national income, illustrate a linkage between the economy of a country and the number of qualified engineers per capita (Watermeyer, 2006).

Table 3 indicates that despite the perception that South Africa is technologically stronger than other African countries that this is not necessarily the case. South Africa has a significantly higher per capita income than countries such as Tanzania and Namibia yet according to Lawless (2005) South Africa's ratio of population to engineer is not significantly better than Zimbabwe, Namibia and Tanzania and other less developed countries. Accordingly, there is no reason why the model should not be able to be applied in other developing countries within Africa.

**Table 3:** International registered engineer to population statistics

<b>Country</b>	<b>Population per registered engineer (after Lawless, 2005)</b>	<b>per capita Gross National Income, US\$ (World Bank, 2005)</b>
Norway, Finland, Denmark and Canada	≤200	28 390 to 52 0303
Sweden, Germany, France and Ireland	201 to 300	30 090 to 35 770
Japan, UK, USA, Australia and Hong Kong	301 to 500	37 120 to 41 400
Malaysia and Chile	501 to 1 000	4 650 to 4 910
Singapore, Korea, Hungary and Romania	1 001 to 3 000	2 920 to 24 220
South Africa	3 001 to 5 000	3630
Sri Lanka, Tanzania, Namibia	5 001 to 7 500	330 to 2 370
Swaziland, Zambia and Ghana	≥12 000	380 to 1660

## **CONCLUSIONS**

The implementation of the model on the pilot project has demonstrated that:

- allocated medium term budgets for a programme of works can be spent not only in a manner that results in construction works of an acceptable quality being delivered in response to prioritised needs, but also in a manner that contributes to the regional social and economic agenda including employment and skills development;
- it is possible to procure the services of a number of consultants and contractors to deliver a programme of works in the absence of a detailed scope of work within a public sector procurement regime;

- it is possible to mobilise a project team to tackle a large infrastructure project within a relatively short period of time once a decision is made to proceed with a project;
- long term, large contracts rather than short term small contracts permit service delivery to occur at scale;
- large, long term contracts can, effectively and efficiently deliver on a wide range of social and economic objectives; and
- the demands placed on a client for its implementation are minimal. .

The target contract approach whereby the target price is negotiated once the scope of work in a water district is known has provided the client with complete flexibility in deciding on priorities and has enabled a well structured and focussed contractor development programme to be implemented with clear and measureable outcomes. The scale of the project has allowed a focussed mentorship programme to be implemented to ensure that the targeted construction businesses put in place business systems to ensure that they grow in a sustainable manner.

This delivery model using large well established contractors has been able to deliver jobs to the unemployed efficiently and effectively. The money paid to such workers which amount to 21 % of total project cost in the early stages of the project where the start up cost are high, compares very favourably with the achievements of the well known Soweto's Contractor Development Programme which ran from 1988 to 1998. (Soweto's programme, which replaced secondary water mains, involved small labour only contractors and third party management support in the form of construction and materials management. This programme enabled 28 percent of the construction cost, excluding programme management and design and supervision costs, to be paid to small contractors. (Watermeyer *et al*, 1995). This is contrary to the popularly held belief that contracts should be made small to ensure that work is labour based and executed by small local contractors.

There are two distinctly different strategies to address the current lack of service delivery and poor project outcomes. The first seeks to significantly increase the numbers of built environment professionals within government to effectively and efficiently manage and oversee the current approach to delivery. The second harnesses the capability and capacity of the built environment professionals located within the private sector to delivery infrastructure using a radically different delivery process.

The model which eThekweni has implemented harnesses the capability and capacity of the private sector to deliver and in so doing has dramatically reduced the staffing requirements of the client. As such it can offer a solution to overcoming capacity constraints in the public sector not only in South Africa but also in other developing countries in Africa.

The model's implementation has the potential to turn around the poor service delivery or non-delivery that is frequently encountered in developing countries.

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